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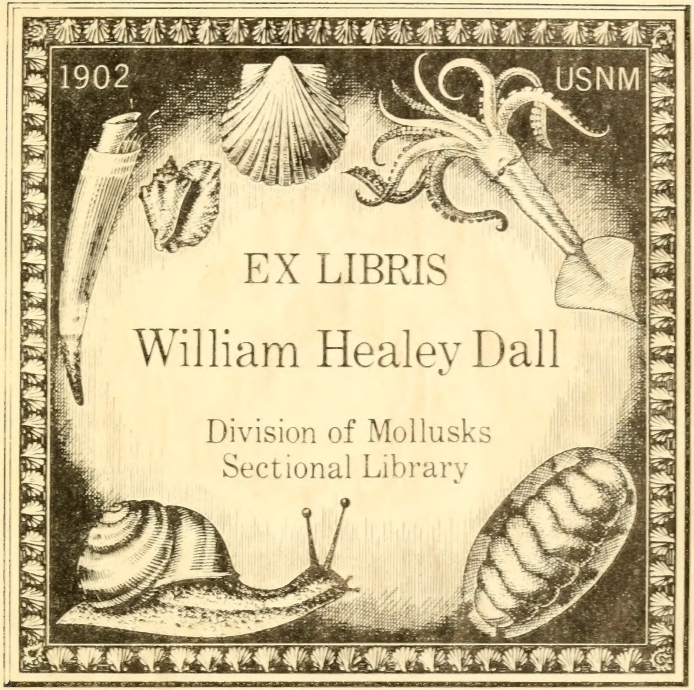
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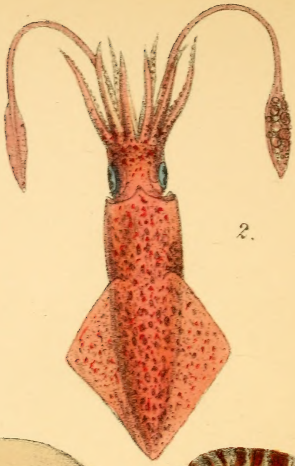

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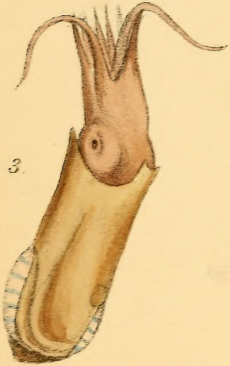

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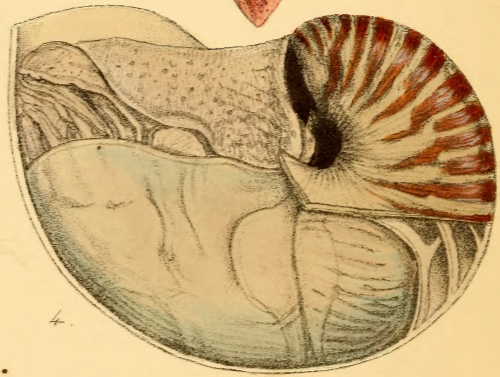

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A

POPULAR HISTORY

OF THE

MOLLUSCA;

COMPRISING

A FAMILIAR ACCOUNT OF THEIR CLASSIFICATION, INSTINCTS, AND HABITS, AND OF THE GROWTH AND DISTINGUISHING CHARACTERS OF THEIR SHELLS.

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BY

MARY ROBERTS,

Author of 'The Conchologist's Companion,' &c.

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PREFACE.

The following pages, compiled chiefly from the writings of Mr. Reeve, treat not so much of shells, as of their animal occupants; and this is desirable, because shells are too often regarded as merely objects of ornament or of fancy. Owing to the retired habits of the Mollusca, and to their soft and perishable nature, Conchology has but slowly advanced in the true spirit of a science. Considerable additions have, however, been made to our knowledge of the animals by drawings taken of them of late years in a living state, and a sufficient number and variety of typical kinds have been examined to afford a tolerably ample view of the whole. Although a very large proportion of the Mollusca are

known only as yet by their shell, so many characteristic generic forms have been described, that the nature of nearly all may be fairly determined by analogy.

The species selected for illustration in the present work are represented as they appear alive. It would not be possible to form a cabinet collection of them in this state, for even when preserved in spirits the soft or molluscous portion becomes, in a measure, contracted and discoloured: but the shells or hard parts are readily collected, and it is hoped that the following popular account of the instincts and habits of the constructing animals will render their shells more intelligible and of greater interest.

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POPULAR

INTRODUCTION TO CONCHOLOGY.

CHAPTER I.

CONSTRUCTION OF SHELLS.

There is such beauty in all natural things,
That e'en the loneliest heart for a small space,
While gazing, musing, as on dove-like wings,
May soar above the heavens, and take her place
In warbling thanks; till wan grief's dread array
Seem but as dreams that troubled the dark night,
Fled with her shades, when the clear eye of day
Doth look upon them, and the heart grows light.

The science of Conchology comprises much that is curious and beautiful. It treats concerning the structure of testaceous shells, of the nature and habits of their animal inhabitants, and speaks, as with a voice from out the waters, of things pertaining to the instincts and formation of those wondrous creatures which stand foremost in the lower division of the Animal Kingdom.

The creatures of which we speak are termed Mollusks, a word derived from the Latin, and signifying soft, for their nature is fleshy and unjointed, boneless, and (except in the most highly organized), without even an internal cartilaginous frame-work. Each individual may be consequently regarded as composed of two parts; the one, endowed with organs of motion, vision, and muscular contraction, peculiarly adapted to its nature; the other, its shell or habitation, which is generally hard and calcareous, partially or entirely covering the inhabitant, which is attached to it by means of muscles; and, however unimportant some of the species may appear, we shall certainly discover that they are as exquisitely contrived, and as carefully wrought for the place and station which they are designed to fill, as the higher orders of creation. Nay, further, if we consider the prodigious number of individuals, the shape and construction of their little bodies, their motion, instincts, and, to say no more, the incomparable beauty and lustre of the colours with which their coatings are shaded and adorned, where shall we discover more striking demonstrations of an Almighty Creator, than in this minute and, till lately, neglected branch of natural history?

Some species inhabit the sea; others, fresh water: others,

again, the land. Their instincts in general appear superior to those of their relatives, the undefended mollusca; and with regard to every other class of organized beings, there subsists, besides several points of resemblance, a general relation of a very peculiar kind. This is the relation of inversion, the law of contrariety; for as in other animals the bones to which the muscles are attached lie within the the body, in mollusks they are placed externally. The testaceous coating forms an outer protective skeleton, and furnishes to the muscles that fixed basis, without which, mechanically, they could not act. All this most strikingly evinces a pursuance of the same plan.

But how, it may be asked, are the shells of the mollusca constructed; and what are their component parts? Shells may be regarded as epidermal in their character, being formed upon the surface of a filmy cloak-like organ called a mantle, and which answers to the true skin of other animals. A slimy juice, consisting of a membranaceous tissue, consolidated by an admixture of carbonate of lime, exudes from the glands of this important organ, and thickening in successive layers becomes hardened and moulded on the body; at first simple and unadorned, but subsequently embellished according to the taste or inclination of the occupant.

Each shell is therefore composed of animal and calcareous matter; the first constitutes a membranaceous basis, which is equally curious and beautiful, being either formed of cells with hexagonal walls, or else of laminæ, more or less wrinkled like morocco leather. But however differing, they are both recipients of the calcareous matter already mentioned; the lime in both cases imparting solidity to the membranaceous tissue, that would otherwise be little more than a mere cobweb. Procure, for instance, the shell of any specimen of *Pinna*, and break off a small portion from the thin margin of the outer layer which projects beyond the inner; submit that portion to a low magnifying power, and when examined by transmitted light it will present, on each of its surfaces, very much the appearance of a honeycomb. Look narrowly and you will discover further, that whilst at the broken edge it exhibits a fibrous aspect, itmay be compared, in reality, to an assemblage of basaltic columns. A still closer inspection will reveal that the shell is composed of a vast number of prisms arranged perpendicularly to the surface of its laminæ, forming the thickness by their length, and the two surfaces by their extremities. And each of these, although composed of very homogeneous substances, are separated by strongly marked hexagonal divisions, resembling

those of the pith or bark in vegetables. Some pass from one surface of the layer to another; others terminate in points midway, marked by delicate transverse striæ. A few may be compared to small burnished mirrors, or large nuclear spots. The hinge-tooth of the *Mya* exhibits a very curious variety in large cells occupied by carbonate of lime disposed in a radicated form of crystallization, resembling that of the mineral called Wavellite. Nor less curious than beautiful is the internal layer of different kinds of bivalves, which present a nacreous or iridescent lustre, the result of its surface being varied with a series of grooved lines running nearly parallel to each other. In like manner the well-known Ear-shell, *Haliotis splendens*, has been ascertained to consist of numerous plates resembling tortoise-shell, alternating with thin layers of pearl or nacre, which exhibit, when highly magnified, a series of irregular folds. The iridescent hues are often extremely pleasing; and if a piece be submitted to the action of diluted acid, till the calcareous portion of the nacreous layers are dissolved, the plates of animal matter fall apart, each one carrying with it the membraneous residuum of the layer of nacre that belonged to its inner surface. But the nacre and membrane covering some of these horny plates remain undisturbed, and their

folded or plaited surfaces, although divested of calcareous matter, exhibit iridescent hues of the most gorgeous description. But if the membrane is spread out with a needle, and the plates unfolded to a considerable extent, the iridescence is no more seen; a fact which clearly demonstrates that the beautiful effects presented by the nacreous portion of shells, commonly called mother-of-pearl, is produced by the disposition of single membranaceous layers in folds or plaits, lying more or less obliquely to the general surface. Fairy prisms are they, refracting rays of light that fall upon them, and presenting a constant succession of rich and varying colours that

> "Flying several from each surface, form
> A trembling radiance of revolving hues,
> As the site varies in the gazer's hand."

The most resplendent nacre is that with which the large *Avicula* of the Pacific adorns the interior of her shell; and the pearl, called by Orientals a globe of light, is the product of its superabundant flow.

Young conchologists, who cannot pursue the investigations of scientific men, may yet derive much pleasure from an easy chemical experiment, in the operation of which shells become distinctly exhibited, without any material alteration

from the nature of the solvent. Thus if a sufficient quantity of nitric acid, considerably diluted either with water or spirits of wine, is poured upon a shell contained in a glass vessel, it will soon exhibit a soft floating substance, consisting of innumerable membranes, which retain the figure of the shell, and afford a beautiful and popular object for the microscope. In analysing shells of a finer texture than such as are generally submitted to the test of experiment, the greatest circumspection is necessary. So much so that M. Herissant, whose attention was particularly devoted to the subject, after placing a porcelain shell in spirits of wine, added from day to day, for the space of two months, a single drop of spirits of nitre, lest the air, generated or let loose by the action of the nitric acid on the earthly substance, should tear the net-work of the fine membranaceous structure. This gradual operation was attended with complete success, and a delicate and beautifully reticulated film, resembling a spider's web in texture, rewarded the patience of the operator; the organization of which, from its extreme fineness, he was not, however, able to delineate. In shells of peculiar delicacy, even five or six months are sometimes necessary for their complete development; but, in others of a coarser texture, the process is soon completed.

Many beautiful configurations are afforded by the membranaceous parts of different shells; that especially which is disclosed in the laminæ of the Oyster, Mussel, and Sea-ear, after exposure to the action of diluted nitric acid.

Such are the materials of which the shelly structures of mollusks are formed,—a combination of small means, and yet productive of exquisite results; of materials, too, for chemistry, touching them with her wand, discovers that neither costly metals, nor bright gems, nor glittering sands, are brought for their construction and adornment; but simply gluten and calcareous particles, apparently of little worth.

CHAPTER II.

GROWTH AND HABITATION.

Oh, there are curious things of which men know
As yet but little!—secrets lying hid
Within all natural objects. Be they shells,
Which ocean flingeth forth from off her billows
On the low sand, or flowers, or trees, or grasses,
Covering the earth; rich metals or bright ores
Beneath the surface. He who findeth out
Those secret things, hath a fair right to gladness;
For he hath well performed, and doth wake
Another note of praise on Nature's harp
To hymn her Great Creator.

Shells form either a coat-of-mail, or shed, or marine pavilion, adapted to the exigencies of the wearer; and no sooner has a young mollusk, whether oviparous or viviparous, emerged to life, than its embryo shell increases by the gradual deposition of lime and gluten from the mantle, in such varieties of form as pertain to its habits and destination. Though inferior

in organic development to that internal frame-work which pertains to the higher orders of vertebrate animals, each kind has its allotted period and uniformity of growth, and exhibits certain characters and impressions equally indicative of peculiar structure, and suggestive of subsidiary characters for the distinction of groups.

The *Cowry* shell may be known by its highly polished and porcellaneous surface to be more or less enveloped by some appendage of the animal inhabitant; the *Siphonaria* offers indications of a siphon; the *Venus* reveals the form assigned to the lobes of the mantle; and who may observe the series of holes that embellish the *Haliotis* without conjecturing that they answer some important purpose in the animal economy? And his conjecture would be right; for they are perforated, at different periods, for the passage of organs conveying water to the breathing apparatus.

The same obvious reference to beauty of effect, which gave rise to an arrangement of little prisms for refracting rays of light, and thus producing a variety of iridescent hues, is equally apparent in the configuration of different shells. This pleasing fact is strikingly exemplified in the spiral form of many of these elegant receptacles. Round or oblong cases would effectually defend the inhabitants

from external injury; but these require in their construction a considerable quantity of the viscous exudation already noticed; whereas a thin coating, fitted to the shape of each individual, answers the purpose equally as well, and moreover enables it to feel the vibrations of the aqueous element in which it frequently resides.

Thus, in subserviency to this general system of economy, as well as in accordance with the instincts of the animals themselves, we find that different species of mollusks are enclosed in various kinds of testaceous coverings. Those which defend the active family of *Donax* enable them to dart away on the approach of danger; while the shells of their more inactive relatives, the perambulating *Solens*, are admirably adapted to assist their movements through the yielding sand. The martial *Chitons* walk abroad in coats-of-mail, fitting like plate armour, and surrounded with horny belts or margins, often covered with scales. The shields of the *Pholades* bristle with points resembling a file, by means of which they are defended from external injury, when occupied in slowly excavating the hardest substances; and the hospitable mansions of the peaceful *Pinnæ* are sufficiently large for the admission of their unassuming guests. The conical shaped shells of the *Patellæ*, or Limpets,

remind the traveller of Anchorites dwelling by the sea-side in solitary tents. The *Helices,* or Snails, slowly perambulate the garden walks, with coverings that resemble the awnings of broad-wheeled waggons. The *Cardia,* or Cockles, are provided with thick coatings, which enable them to endure the rough beating of a boisterous sea; and the shells of such species as are fragile and transparent, and scarcely able to resist the slightest pressure, are found in still ponds and muddy ditches. Some possess a solvent property, and are thus enabled, by little or no expenditure of muscular power, to effect important changes in their condition.

Snails produce indentures in limestone walls even when quietly at rest. *Pholades* pierce the hardest limestone rocks, and increase in size while remaining willing prisoners within stone walls, without the slightest injury to their delicate and highly finished shells. The *Cowry,* when arrived at maturity, has even the power of partially dissolving a considerable portion of his shell, and repairing or enlarging it, according to his exigencies. Thus also has the *Cone;* when young, the inner spiral partitions of his shell are thick and solid, but when adult they are absorbed to a degree of thinness, which, at an earlier period, would not have been strong enough to support the primitive structure. Some mollusks

remove with ease whatever presents an obstacle to their convolutions of growth. In the *Murex cornutus*, for example, this mode of operation may be occasionally traced, by observing on the left side of the aperture the base of a spine, which had evidently been taken away for the purpose of covering the boundary of the aperture with a coating of enamel. The *Cowry* can even form a new shell when fully grown: a phenomenon which modern naturalists long hesitated to receive; but which is now proved beyond doubt by Lieut. Hankey, who was himself an eye-witness of the curious fact, and who relates that he has seen the shell of a Cowry, when too small for its occupant, begin to crack and swell; at which time some powerful solvent or decomposing fluid had evidently been distributed over its outer surface by that all-important instrument, the mantle; for it gradually became more dull in colour and thin in substance, till at length the shell disappeared, and the Cowry was rendered homeless. Short time, however, elapsed before the creature set to work, and secreted a thin layer of glutinous matter, which in a few days assumed the fragile consistency of shell-lac. The dwelling then rapidly progressed, till at length it was consolidated into one of those beautifully spotted shells, which equally ornament the widow's cottage, cherished as

remembrances of her sailor boy, and the costly cabinets of the shell collector.

The inner portion, or rather columella, with its spiral compartments, however, remains undisturbed. The animal inhabitant merely dissolves the outer portion of his shell with an acetous juice, exuding from his mantle, which is capable of being extended over the shell; and the same power which enables him to furnish his last coating of enamel can be exerted in the formation of superior cumbent layers to replace what he has thought proper to remove. Thus, also, the *Murex* readily displaces spines, or any similar obstacles which impede an enlarged growth; while the *Pholades,* as already noticed, and other terebrating mollusks, exercise a faculty which enables them to penetrate the hardest limestone rocks.

The structure of the Cowry shell is, moreover, peculiarly tenacious of absorption; it is composed of a larger quantity of carbonate of lime than membranous substance,—a fact which readily accounts for its surface becoming vitrified or polished by continual contact with the acid secretions of the mantle. And as respects the formation of a new shell, it is worthy of remark, that the glutinous matter which resembles shell-lac, and is so fragile as to crack with the slightest

touch, does not assume the narrow cylindrical *Bulla*-form, nor yet revolve around a columella axis; it takes the wide ventricose shape of a *Cymba*, and rapidly consolidates into the adult shell. It is therefore evident that the *Cypræa* removes at will any portion that impedes his full development; that when his house becomes too small for his comfortable occupation he causes it to melt away as by the touch of an enchanter's wand; and lastly, that he reconstructs with equal facility the beauteous edifice that constitutes his home. The operation is, however, said to be of rare occurrence, and to happen only under peculiar circumstances.

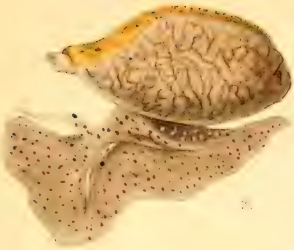
Yet not less wonderful is the gradual increase and development of shelly structures, with gradations of form and hue, and architectural embellishments which occur at different periods. It even seems as if the animal inhabitant in progressing from youth to full maturity, acquired new ideas with skill to embody them; and so great a difference subsists between the extremes of age, that shells of young *Cowries* were figured by our forefathers as *Bullæ*. Adanson collected them in a separate genus, with the title of *Peribolus;* and a celebrated continental naturalist of the present day was long unable to abandon this chimera. The changes, therefore, among Cowries, both of colour and of pattern, with

that of form, are so peculiar, that the shell-collector should obtain specimens at different periods of their growth.

First then, and as presenting the earliest attempt made by a young Cowry towards constructing a dwelling, appears a simple convolution of shell around the columella axis, in the form of a long drawn-out *Bulla*, the columella being smooth, the outer lip thin, and the colour usually diffused in wavy bands.

A second epoch of growth succeeds; the shell becomes more solid, the lip and columella begin to thicken, and present gradual indications of teeth, which develope more and more, and the surface is overlaid with a strong coat of livid colouring matter diffused in obscure bands or waves. Another process ensues; for the calcifying energies of the mantle, which extending in two unequal lobes from either side of the shell's aperture, have been hitherto chiefly encrusted upon the back of the dorsal surface, during the second epoch of growth, are now more particularly directed to the base and sides. The teeth are strengthened, the sides become thickened with a rich coating of enamel, and the beauty of the superb arch is rendered perfect by lines or waves, or net-work, of various hues and patterns.

In most species three separate phases of colour pertain to different periods of growth. In the *C. Mauritiana*, for



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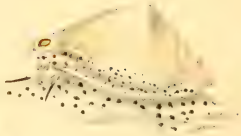

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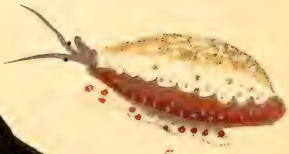

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W. Wing, lith.

Reeve & Nichols, imp.

example, the first tinting in its *Bulla* form, is pale yellow, with wavy bands; in a second stage the waves become agglomerated, and leave the yellow in triangular flame-like spots; the teeth, meanwhile, are fully developed, and the sides are thickened by means of a rich dark brown coating, thinly spread over the dorsal surface, and forming irregular reticulations, as if by the admixture of some oily liquid.

A uniform pure, clear milky orange colour, designates the first growth of the Scott's Cowry, *C. Scottii*. It then assumes a bluish tinge, disposed in obscure bands, and begins to show a few bright tortoise-shell brown blotches, which rapidly accumulate, as seen in the adult, long before there is any indication of teeth. This arrangement differs from that of most Cowries, in which the teeth are chiefly developed before the last layer of colouring matter is deposited.

Lastly, the sides and base become thickened with an extremely rich and dark brown coating of enamel, and the extremities are compressed and turned upwards. This curious shell was introduced to the knowledge of conchologists by Mr. Broderip, to whom it was transmitted, about fourteen years since, by the Rev. Archdeacon Scott, from the island of Java, and since then several fine specimens have been received from the Swan River, New Holland.

But the most striking instance of gradual development is shown in the Tiger Cowry, *C. tigris*. The colour is at first of an uniform chesnut bay, but afterwards seems to break into bands of close-set waved blotches of a richer hue, a coating of which is then super-imposed, and upon that is deposited a series of rather distant zigzag flames upon a white ground. Thirdly, the mollusk turns his attention towards the formation of teeth, and a few coloured spots become apparent round the outer side. In the next stage, a second layer of white enamel is added, but considerably thinner and more delicate than the preceding, through which zigzag flames may be seen of a milky hue, and upon this surface a number of dark spots are deposited. These, again, are overspread by a thin white coating, intermixed with numerous rich black and brown spots, showing for the first time a narrower dorsal line, mostly edged with reddish brown, having also the first deposit of dark spots overspread with a bluish transparent milky hue.

Many of these splendid mollusks inhabit the shores of the Pearl Islands. They are uniformly found in shallow water under rolled masses of Madrepore, for they never expose themselves to the sun's rays. On lifting one of these masses, a Tiger Cowry was generally observed, with his

shell entirely covered by a large mantle, beautifully spotted with dark colours, the intensity of which seemed changeable at the creature's will; for the colour varied in the same light and medium as spots on the Cephalopodous mollusca. On touching the mantle it was immediately drawn within the shell, of which the brilliancy then became apparent.

The exquisite varieties of hues and patterns exhibited by different members of the *Cypræa* tribe, are formed on reaching maturity. Previous infusions of colour rarely exhibit any thing more than a dull confusion of waves, or clouds, or bands, and no ornamental device is seen, until the shell is perfected; the most richly variegated layers of enamel, and the exquisite paintings are reserved for the final touch of the pencil. A striking exception, however, occurs in the Map Cowry, *C. mappa*. In this a layer of pale hieroglyphic painting is deposited by the animal on the left side chiefly, while yet in an immature state of growth; and on arriving at maturity another and richer layer is added upon the former, which in most specimens may be plainly seen beneath it.

Nor less curious and varied are the habits of the Mollusca than the shells in which they are encased. They likewise possess instincts in conformity with their watery

locations; and though unsightly, and often difficult of access, it is conjectured, with good reason, that they are not inferior in sagacity and architectural skill to the bee and ant; that further, they are equally at home either in the sea or upon land, being expert in swimming or in diving, in leaping or in climbing to a considerable height; nay, it has even been asserted that some species develope qualities analogous to such as pertain to the higher orders of Mammalia.

All watery zones have, therefore, their molluscous occupants. Some inhabit the deep sea; others are found along the shores at different depths, either in mud, or sand, or gravel, on coral reefs, or else nestling beneath overarching rocks at low water. Stationary sea-weeds, that form marine groves, are the haunts of many an home-loving mollusk; whilst others prefer to float on vegetable cars:—

> "Flung from the rock, on ocean's foam to sail,
> Where'er the waves may urge, the tempest's breath prevail."

Others, again, remain embedded in wood, or coral, or limestone rocks. Such as inhabit ponds and marshes are generally of a dull and stagnant nature, and are either borne upon the surface or attach themselves to weeds. Such as are assigned to rivers, float up and down with the tide, or remain stationary by the aid of water plants; lastly, such

as abound on hills and in forests live upon the branches of trees, or creep among roots and shrubs, or decayed and fallen leaves.

The common *Oyster* hides itself among stones; others become parasitic, and cling to the roots and branches of such trees as dip into the water. *Mussels* often ride at anchor in shallows of the sea-shore; and *Pinnæ* moor their fragile barks to huge pebbles by means of silken cords, which are spun in a manner analogous to spider-webs. Silver-tinted *Anomias* may be seen calmly riding on the currents of the ocean, attached to floating tufts of sea-weed; while many of their brethren resemble tiny vessels, safely moored in the little coves that are formed by the tree-like fabrics of innumerable corals.

The shell-collector has frequently observed the beautiful effect produced by the shells of different Mollusks when either adhering to marine rocks or else perambulating beneath the waters. On walking over the island of Cyprus, he was particularly struck with the number of brilliant Limpets for which that classic spot is so much celebrated. Considerable numbers had fixed themselves to branches of white coral, where they resembled the delicate blossoms of the peach; others, which seemed to be inlaid with mother

of pearl, opal and amethyst, clung to the sheltering rocks, as if fearful of being separated from them by the agitated waves of the surrounding element. And while observing their various forms and movements, the shell collector could not help reflecting on the adaptation of those creatures to their different localities, with an earnest wish to unravel the mysteries of their existence. For little as yet is known concerning their connection with different rocks and sea-weeds; still less as regards their fitness for them, or their union with that element which often conceals them in its deep recesses.

Several of the rocks exhibited beautiful specimens of gorgeous sea-weeds, which presented, in the variety of their configurations, long tufts of various hues, or garlands, festoons, or cordages, that trembled and glittered in the water; haunts of innumerable mollusks, some of which exhibited the glowing colours of the rainbow, or tints of the richest tulips; others resembled little marine lamps suspended in the crevices of dark rocks; others, again, appeared as if encased with silver armour, as they walked beneath the spreading branches of the Madrepore.

Different kinds of shells are often invested with an outer covering of considerable beauty, resembling either a thin

skin or a hairy kind of garment. This curious appendage is particularly obvious in different species of *Trochus*, *Conus*, *Triton*, *Unio*, and others, which not unfrequently conceal beneath such extraneous coverings the most beautiful designs and painting. Thus many Limpets, when disrobed of their garment by the application of nitric acid, present an under-surface resembling the finest tortoise-shell, blended with burnished gold. The *Trochus Iris* conceals in like manner a splendid metallic lustre; and numerous species of the genus *Unio*, which are covered with a brown or green epidermis, reveal a brilliantly tinted and pearly surface, glowing with the colours of the rainbow.

St. Pierre, with his accustomed elegance of thought, conjectures that nature has veiled the beauty of these singular productions, in order to preserve it for the admiration of her sons; that she has placed them among the shallows of the sea-shore, where the agitated element polishes them by the continual motion of its waves, in order to throw them within their reach; and that, as if to excite the astonishment of untutored men, she places shells of unrivalled lustre in regions exposed to the fury of the elements, while at the same time she presents the poor Patagonians with spoons and cups, the lustre of which surpasses the richest plate of polished nations.

But why, illustrious naturalist, did your observations extend no further? Saw you nothing, in these darkly-coated and brilliantly-tinted shells, but an arrangement of bright colours to please the eye of taste, or cups and spoons for the rude inhabitants of savage districts? Saw you not that the Almighty Creator of the universe (without whose permission a single hair does not fall from our heads, nor a lonely sparrow to the ground, neither is a shell or a pebble rolled by the billows upon the shore,) provides against their utter extinction through the depredations of sea-birds and rapacious fishes, by investing them in simple colours, while at the same time he spreads abroad for these a constant supply of food, in the desolate sites of earth or ocean which they are appointed to occupy?

The Roman naturalist noticed with admiration the transformation of several species of caterpillars from an intermediate state to that splendid investiture of spring, when still preserving their identity, and having passed from the baseness of a worm, they burst the silken shroud which envelopes them, and traverse the air in a form that is dazzling to the eye. The Egyptians apparently referred to this intermediate state, and to the change which follows it, in the configuration of their mummies; for the most ancient are

swathed and filleted, so exactly after the fashion of the Eruca or chrysalis, that the resemblance could not be accidental. The sages of that country, who expressed all their notions by symbols, also signified the supposititious transmigration of the soul by the transformation of the insect; and the Grecian poets, improving on this idea, made use of the same symbol to designate its immortality. In like manner the botanist confesses, in the unfolding of the calyx which covers the gaudy head of the oriental poppy, an attractive emblem of the expanding of the human mind, as it emerges from a state of ignorance; and in the gradual development of a plant, the progressive advancement of every moral excellence.

And shall no tender or appropriate emblem rise in the mind of the conchologist, when he observes the tints of the aurora, or the colour of gold or purple amethyst emerging from under a rough tartar, or shaggy epidermis? The Christian philosopher confesses in the humble mollusk a striking emblem of human nature in a savage or unconverted state, without beauty, without comeliness, destitute of all those graces which exalt the man, or adorn the Christian. But, behold, the hand of the refiner is upon him: he emerges from the veil of obscurity which had previously

invested his moral faculties; or rather, to borrow the emphatic language of inspiration, "He is quickened, when dead in trespasses and sins; he stands forth in all the perfection of his nature, and remembering that he is no longer his own, that he is bought with a price, he seeks to glorify his Maker with his body and his spirit, which are His." *

To return from this digression. We admit that shells are beautiful, and that they are admirably adapted to the exigencies of the wearer; but how shall we account for the endless diversity of shades and colours, varying from the sober coating of the garden snail to the delicate and glowing tints which are diffused over some of the finer species, in the infinite profusion of undulations, clouds, spots, bands, and reticulated figures, with which these admirable architects enrich the walls of their beautiful receptacles? The means of producing them must be sought for in the animals themselves. Their mantles are furnished with pores replete with colouring fluid, which blends insensibly with the calcareous exudation already noticed, and thus occasions that exquisite variety in their testaceous coverings, which art attempts to emulate, but can never fully equal.

Thus far the result of observation and experiment. It

* Ephes. ii. 1.

now remains to account for the extraordinary fact that the stony exudations of testaceous animals condense only on those parts where they are essential to their welfare. But here investigation ends—the microscope has done its office. It seems as if maternal nature delighted to baffle the wisdom of her sons; and to say to the proud assertors of the sufficiency of human reason for comprehending the mysteries of Creation and of Providence, "Thus far canst thou go, and no further." Even in the formation of a shell, or its insignificant inhabitant, your arrogant pretensions are completely humbled!

"Proud, scornful man! thy soaring wing
Would hurry towards Infinity:
And yet the vilest, meanest thing
Is too sublime, too deep for thee;
And all thy vain imaginings
Lost in the smallest speck we see.

It must be so:—for He, even He
Who worlds created, formed the worm;
He pours the dew who filled the sea,—
Breathes from the flower who rules the storm:
Him we may worship,—not conceive;
See not, and hear not,—but adore;
Bow in the dust, obey, believe;
Utter his name, and know no more."

BOWRING'S *Matins and Vespers.*

CHAPTER III.

GEOGRAPHY OF SHELLS.

There is most perfect order in all things;
The smallest sea-weed hath its growing-place,
The humblest shell its rock, or cove, or bay,
Or ocean-haunt. And tribes there are that dwell
Apart in sunny climes; by ice-girt rocks
Dwell some of sober hue; and some delight
To range all seas, from Indus to the Pole.

The geographical distribution which universally prevails throughout the animal and vegetable kingdoms, is a subject fraught with the deepest interest. It brings before the mind some apprehension of the harmony and order of the universe; of those fixed and certain laws, which even the humble mollusk seems instinctively to obey.

As yet the sub-marine provinces of shells have not been traced with the same accuracy as those of terrestrial animals and plants; but sufficient has been ascertained to prove that

even in the plains of ocean, where apparently no barriers exist to prevent the onward progress of innumerable mollusks, their boundaries, both with regard to latitude and longitude, will be found in general well defined.

Some species attain a full development in warm latitudes, and are restricted to the torrid zone; others abound in temperate climates; and many, of small size and less highly coloured, inhabit the arctic regions.

Cones, which are mostly inhabitants of deep water, are nearly all tropical; their vivid colours seem in accordance with the aspect of vegetation in sunny climes. *Cowries* also belong to the same latitudes, with the exception of one or two small grooved species that are found on our coasts. New Holland and the Pacific have each their species, and the *C. pantherina* is brought in great abundance from the Red Sea. *Cymbiums* and *Melons* are found in Australia; but the greater number are from the coast of Africa, where they burrow in the sand at low water, and live mostly concealed from view.

Beautiful *Volutes* strew the shores of Australia, New Guinea, and New Zealand; a few species, those of the Brazils and Ceylon, Timor, and Western Africa. Peculiar as regards their places of abode, they rarely inhabit localities where

Mitres abound. In the Philippine islands, where Mr. Cuming collected between two and three hundred species, scarcely a *Volute* was to be seen.

Marginellæ are mostly found within the tropics; while the *Terebræ* chiefly inhabit the eastern world, and are peculiar to warm temperatures, one species only reaching so far north as the Mediterranean. *Olives* are exclusively confined within tropical regions; and the *Nassæ* are equally restricted to the southern and tropical portions of the globe.

The *Magilus* especially effects the shores of the Red Sea; the *Harps* those of Ceylon, the Mauritius, and the Philippine islands. *Cassides*, or Helmets, are found in the same localities as the *Magilus*, with the addition of Ceylon and the West Indies. *Struthiolaria* inhabit the shores of New Holland; and the finest specimens of *Rostellaria* are from China and the Moluccas. Others, unlike the restricted tribes, are generally distributed throughout the globe. *Strombi* are found in places the most dissimilar, such as the West Indies and Australia, Ceylon, and the Red Sea. *Tritons* equally reward the labours of conchologists, whether searching for them in the United States, or the Cape of Good Hope, along the shores of New Holland, or those of the Moluccas.

Cancellariæ, Chitons, Fissurellæ, and many beautiful genera are associated with the memory of the Incas in Peru; they also bring to mind the Gulf of Panama, where Pearl fisheries abound; China, with its pagodas and Mandarins, the classic shores of the Mediterranean, and the Eastern Archipelago, for such are their favourite localities.

The Gulf of Tarentum and the coast of Naples and Sardinia afford varieties of porcelain shells, with *Pectens* of all hues. The island of Sardinia is celebrated for a fine species of white Oyster; and Corsica, Majorca, and Minorca, for the *Pinna marina,* the Silk-worm of the ocean. Bright yellow *Ancillariæ* and orange-brown *Eburnæ* are found on the shores of New Holland and Japan; and the solitary *Concholepas,* resembling a compressed cornucopia, has alone been discovered at Peru.

There is scarcely, on the contrary, any limit to the geographical distribution of the *Neritinæ,* save in the arctic regions, and cold temperate zones. The genus is represented by a humble but very delicately painted specimen, on the shores of Britain; and numerous varieties abound in the West Indies, and throughout the great continent of America. This extensive genus is equally diffused in South Africa

and the Eastern world. Magnificent specimens were collected by Mr. Cuming in the Philippines, in Sumatra also, and other islands of the Oriental Archipelago.

The range of the *Helix putris* is considerably extended, and comprises a great variety of soil and climate, from dark Norwegian forests to sunny Italy, creeping at its slow and stealthy pace throughout the United States and Newfoundland, Jamaica, Tranquebar and the Marianne Islands. The margin of pools and streams, where aquatic birds resort to bathe and dress their feathers, are his favourite haunts; hence the dispersion of the *H. putris* is readily accounted for. The eggs being generally affixed to the stems and leaves of water-plants become attached to the feathers of such birds as resort among them, and are in consequence widely disseminated.

The *H. aspersa*, one of the most common among our larger land shells, is dispersed in like manner through places the most dissimilar. St. Helena and the foot of Chimborazo, in South America, reveal its olive-coloured shell, as also the citron groves of Cayenne. But with this difference, it is conjectured, that the species being considered nutritious, were imported from casual ships; their power of sustaining life without air or nourishment during the longest

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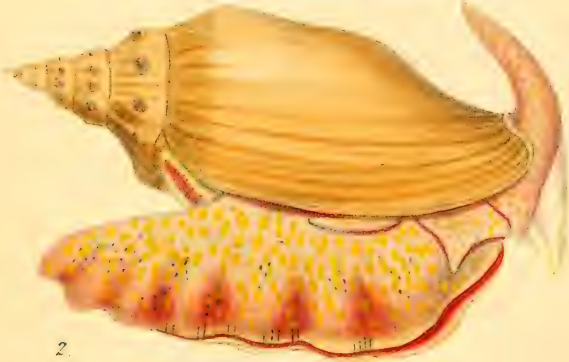

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voyages, being equalled only by their ready assimilation with opposite climates.

It seems, also, as if some unknown causes affected not only the hue but the size of shells. Peron and Lesueur remark that those pertaining to the *Haliotis gigantea* of Van Diemen's Land, and the *Phasianella*, diminish in size as they follow the coasts of New Holland northward of King George's Sound, and that they entirely disappear beyond them.

Obstacles without doubt exist to the migration of various species, such as continuous lines of continents stretching from north to south. Were it otherwise, the *Nautilus*, and *Argonauta*, and *Ianthina* would everywhere abound; but the reverse occurs; and hence the molluscous inhabitants of shells that pertain to the West Indies cannot enter the Pacific without passing through the inclement regions of Cape Horn. Currents, also, flowing permanently in certain directions, with the influx at prescribed points of vast quantities of fresh water, limit the extension of many species. Those which love deep water are arrested in their progress by shoals; others, fitted by their construction for shallow seas, cannot migrate across those yawning chasms that open in the bed of ocean. The nature also of the ground exercises an important influence both on land and water shells. Some

species prefer gravel; others, a fine sand; others, again, conceal themselves in mud. Limestone rocks are especially resorted to by various species of the genera *Helix*, *Clausilia*, *Bulimus*, and others.

In dredging the Ægean Sea, Professor E. Forbes discovered eight well-defined zones, each characterized by its peculiar family of shells. The first, termed by conchologists the littoral zone, extended to a depth of two fathoms only, and though in itself a narrow belt, was tenanted by more than one hundred species. The second region, embedded at the depth of ten fathoms, was almost equally populous; and a copious list of species is given as characteristic of each region down to the seventh, which lay between the depths of eighty and one hundred and five fathoms. Deeper still, appeared an inhabited space included in the eighth province, where no less than sixty-five species of Mollusca were discovered. Of these, the majority, beyond the influence of light, were equally white and transparent.

We might speak more at length concerning the marine deposit of bright shells on the coasts of Cayenne, with those of Madeira and the Straits of Magellan. We might mention that curious specimens of *Trichotropis* have been found at Icy Cape; and that the *Murex trunculus*, the *Tyrius Murex*

of Ovid, still exists beside the ruins of the ancient Phœnician city of Tyros; but the instances already cited will suffice to show that different kinds of mollusks, equally with animals and plants, have their assigned localities, and that some specimens of great beauty appear as if restricted to certain portions of the globe.

Such, then, are a few localities of the shell tribe; of those first-fruits of the ocean which make the heart beat with delight in discovering and possessing them. How vividly that bright moment recurs to my remembrance, when the deep proud sea first rose upon my sight;—when I first heard the loud cry of the returning sea-gull, and saw the dancing waves bound upwards, as if in defiance of the rocks that repelled them. And how pleasingly, too, arises the thought of those glad hours when the sportive billows threw up their beautiful Sea-weeds and Shells, with long, trailing *Fuci*, and light grey Corallines;—when ocean seemed to say, Stranger, you have, perhaps, travelled far, and seen much of groves and gardens, of inland valleys and green hills; but the earth, from which you spring, and on whose bosom myriads have lain down to rest, brings neither to the heart nor to the imagination that vivid delight which my ever-varying productions yield. There is somewhat of sadness

blended with all of earth's productions; they fade and change; they tell of by-gone days, and of friends who may not greet again her beautiful interchange of fruits and flowers. But mine are always new: no sad thoughts are blended with them, for the steps of mortals are not upon my fields. All that my billows throw forth to the bright sunbeams are fresh and beautiful; and it is not till they have been received on earth's dull bosom, that they partake of her nature and begin to fade.

What bear ye now, ye dancing waves,
In your wild delirious play;
Sea-weeds or shells, from the coral caves,
Where the flocks of ocean stray?

I have waited long 'mid the deafening roar,
And the spray of your revelry;
Oh, spread ye now, on the sounding shore,
Those gifts from the deep, deep sea.

Our steps are not on her pathless plains,
Where the beauteous sea-weeds grow,
And the Pinna weaveth her silken chains,
By the light of the Sea-star's glow.

Oh, the light of that lamp, how it purely beams,
In the midst of the deep, deep sea,
Lighting her halls where the rapt bard deems
Are wonders no mortal may see.

For who can walk where the Nautilus hides,
When her silken sails are furl'd;
Where retreat in their fury the baffled tides
From the shores of this upper world?

Wonderful creatures are haunting there,
In the tumbling and tossing main;
Coral insects are rearing their fabrics fair,—
A busy, ephemeral train.

Oh, the works of men are not form'd to last,—
They crumble and fade away;
Time's noiseless tread or the wintry blast
May hasten their sure decay.

But the island on which his proud steps tread,
Where his home or his grave may be,
Those small workmen have rear'd, and their fabrics spread,
Bright gems of the deep, deep sea.

The sea-bird soars in the eddying spray,
From those isles, 'mid the wild waves' foam;
And beautiful things, which the tides convey,
Strew the shores of each sea-girt home.

Sea-weeds, and shells, by the sparkling waves
As in sport on the wild shore hurl'd;
Sprays of coral, broke off from old ocean's caves,
In the depth of the briny world.

Oh, the flowers that look up from this smitten earth,
As with hope, to the realms of air,
Though of showers and sun-beams the beautiful birth,
Take a hue from our deep cast of care.

But those gifts of the tossing main
From the hues of our fortune are free;
No thought of the past with its sadness may stain
Those gifts of the deep, deep sea.

CHAPTER IV.

Sub-Kingdom MOLLUSCA.

"There are more things in heaven and earth, Horatio,
Than are dreamt of in our philosophy."

Cephalopods, a group of active, voracious animals, stand first in the molluscous series. Their name is derived from two Greek words, signifying a head and foot, and their physiological condition is not much inferior to that of fishes. They are all marine, inhabiting deep water, and only a limited number produce a shell of any particular substance. The head and body resemble an oblong bag, of which the upper portion is crowned with numerous arms, or tentacles, covered with suckers; and, as their name implies, they walk with the head downwards.

Gastropods comprise a numerous class, whose habits are less active than those of the preceding, and in whom the

masonic art is more fully and variously developed. They equally inhabit sea and land; some are even found suspended by a peculiar kind of net-work to the boughs of trees; others inhabit rivers and stagnant pools. Their heads and eyes are distinctly formed, and they move readily by the aid of a contractile and expanding disc.

Pteropods include a limited class of small, twilight, deep-water swimmers, which move readily, as their name indicates, by means of a pair of wing-like fins. These creatures produce a small brittle shell, resembling glass.

Lamellibranchiates are next in the descending scale of organized beings. They form an extensive tribe, whose mantle is divided into two lobes, each with a separate piece of shell, connected by a horny ligament. The *branchiæ*, or breathing organs, are arranged in thin plates; and, strange to say, the group is uniformly headless: a considerable number are even incapable of motion.

Brachiopods, last of the molluscous series, have also a bivalve shell, and are uniformly without a head. This group is parasitic; their peculiarity consists in having a pair of spiral arms, and they are differently placed within the shell.

Class I. CEPHALOPODA.

> Strange creatures range the deep; methinks stout hearts
> Might quail before them; huge mis-shapen forms,
> Such as the earth owns not, nor men have fed
> In quiet pastures; yet allied to these,
> Are such as poets love, and oft have sung,
> By classic streams.

The Cephalopods, or Head-walking mollusks, derive their name from a peculiar manner of crawling upon their arms and tentacles, with the head downward. They present an interesting link between the vertebrate and invertebrate divisions of the animal kingdom: between fishes on one side, and operculated Gastropods on the other. Like the former, they possess an internal cartilaginous skeleton, and are able to speed swiftly through the waters by the aid of a caudal and pair of side-fins; like the latter, three of them secrete a testaceous mucus, and construct a calcareous apparatus, consisting of an involuted shell. Those unprovided with any shell are extremely numerous, and of the most hideous aspect.

The creature herself resembles an oblong bag crowned with arms and tentacles, often of immense length, and provided with numerous suckers, that act as cupping-glasses when the creature has secured her prey. The head, which

seems to peep forth from out a membranaceous bag, has a strong pair of horny mandibles resembling the beak of a parrot, and on each appears a large conspicuous eye, endowed with great quickness of vision. The tribe are consequently well fitted for a predacious mode of life, and are formidable enemies to their watery neighbours. Those only who have witnessed the persevering activity, power, and velocity of motion exercised by the *Octopus*, or Cuttle-fish, when engaged in his destructive practices among a shoal of fishes, can form an adequate idea of his quickness of vision and locomotive powers. Swift as thought his hard-beaked mandibles become buried in the ill-fated victim, which he holds fast by his numerous tentacles; and then, in one moment unloosing his thousand suckers, and disengaging himself from his prey, he darts like an arrow from the net of the fisherman, which has been cautiously moved towards him, in the hope of making him a prisoner.

Octopi of enormous size are occasionally met with among the islands of the Meïa-co-shimah group. Sir Edward Belcher measured one of these ungainly creatures, which two men were carrying on their shoulders across a pole. He found that each arm was rather more than two feet long, and that the mollusk could, in consequence, explore an area

of more than twelve feet in circumference. The same naturalist frequently observed the *Sepiæ* and *Octopi* in full predatory activity; and he had great trouble and difficulty to secure them, so great was their restless vivacity, and so vigorous their efforts to escape. They darted from side to side in their watery haunts, or fixed themselves so tenaciously to the roots and stones by means of their sucker-like acetabula, that it required great strength to detach them. When captured and thrown upon the sand, they still progressed rapidly in a sidelong, shuffling manner, extending their long arms, ejecting their ink-like fluid in sudden violent jets, and staring about in a very grotesque and hideous manner, with their huge shining eyes, which at night are luminous like those of a cat.

Such are the terrific relatives of the chambered *Nautilus*: creatures which have been mentioned in the earliest records of natural history, though little was known with regard to their immediate relation with the testaceous mollusks, until the appearance of a living *Nautilus*, during the last century, established this interesting fact.

Two of the Cephalopods construct shells, and in only one such instance does the shell appear designed for the dwelling of its inhabitant; they are widely distributed throughout

the globe, inhabiting deep waters, and seldom seen except at night. Some of the unclothed brotherhood possess an internal rudimentary shell: the Cuttle-fish (*Sepia*), for instance, has an oval plate; the Calamary (*Loligo*), a long horny shell, resembling a quill-pen; and the *Onychoteuthis*, a thin oblong shell, like a three-edged sword. The highly organized and finned, enjoy more rapid powers of locomotion than such as are encumbered with a shell, but are less adapted to find their home in very deep water. The *Sepia* is less protected than many others against the attacks of his enemies; but then he is provided with a mode of self-defence which the well-armed *Nautilus* does not possess. He carries with him a small bag full of black, inky fluid, and when danger approaches he darkens with it the surrounding water. Thus enabled to elude the vigilance of his pursuers, he readily escapes; while the baffled foe is suddenly enveloped in a darkness deep as midnight. Proteus-like, he has other means of escape, and often may the wily creature be seen changing colour, after the manner of a chameleon, and bewildering his enemy, when in hot pursuit, by the strange aspect which he instantaneously presents.

Others of the same family are also provided with ink-bags; but in these a considerable difference exists. Such as

wander defenceless on the bosom of the ocean are gifted with the power of producing more intense discharges of ink than others of an isolated character, which seek to hide themselves in the cavities of rocks. The same variety of adaptation is also observable in their locomotive powers. Wandering *Cephalopods* are furnished with a pair of lateral fins, by aid of which they move rapidly in their native element; some few have caudal fins, which enable them to swim backwards; the tentacles of others are webbed around the base, like the foot of a duck, and this configuration not only increases their power of swimming, but facilitates their springing out of the water, like flying-fish. Their suckers have ofttimes a formidable character, appropriate to their predacious mode of life; occasionally they assume the appearance of claws, and the fishermen are greatly afraid of them. The sense of vision is very strong in these strange mollusks; many have even the power of turning their great eyes completely round, in a manner similar to those of the chameleon.

Naturalists and poets have especially delighted in the Paper and Pearly *Nautili*: creatures mentioned with brief but marvellous accuracy by Aristotle, when describing the results of a scientific voyage, which he was deputed to

undertake during the reign of Alexander the Great, in order to collect subjects for a natural history of animals, at least three hundred years before the Christian era. The philosopher seems to have met with both the Paper and Pearly Nautilus; for he notices the one as having a shell, though not adhering to it, as feeding frequently along the shore, and liable, when cast by waves upon the sand, to slip from out his shell, and perish in consequence; concerning the other, that he dwells within his shell after the manner of a snail, and outwardly extends his arms.

Such is the brief yet accurate description given by Aristotle concerning these strange creatures. But centuries elapsed before they attracted any further notice, till the time of Pliny, and subsequently about the beginning of the eighteenth century, when Rumphius, a Dutch merchant and naturalist, residing at Amboyna, thus spoke concerning them:—"When they float upon the water they put forth their head and all their tentacles, and spread them upon the surface; but at the bottom of the sea they creep in a reverse position, with their boats above them, and their head and tentacles upon the ground, making a tolerably quick progress, creeping sometimes into the nets of the fishermen; but after a storm, when the weather becomes

calm, they are seen in troops, floating on the water, being driven upwards by the agitation of the waves. Their sailing, however, is not long; for having taken in their tentacles, they upset their boats, and so return to the bottom." This account, published at Amsterdam more than a hundred years since, is mainly correct, although perhaps a little exaggerated; for *Nautili* are never seen in fleets, nor yet are they so familiar as to walk into the nets of fishermen.

Another century elapsed; and, although the waves continually brought up and deposited shells of the *Nautilus* upon the shore, no one seemed to care for them, till a naturalist of the name of Bennett succeeded in capturing a female individual when calmly floating in the bay of Marakini, at the island of Erromanga, New Hebrides. The living specimen was considerably shattered in attempting to secure it, and the shell, being much broken, was injudiciously removed. A minute portion, however, adhered to one of the lateral expansions of the belt, and Professor Owen, to whom the specimen was transmitted, was enabled to confirm the history of this remarkable animal, as given by Aristotle more than two thousand years before.

The soft parts of the animal became in consequence the subject of an elaborate memoir, and are ascertained to form

a kind of oblong mass, capable of fitting into the aperture of the well-known shell. The outer portion presents a perfectly developed head, furnished with a pair of strong horny mandibles, and a number of sheathed tentacles, a pair of large eyes also, and organs for hearing and smelling; and over all these extends a capacious leathery hood, with a concavity fitting to the convex form of the shell, and having apparently a hinge-like movement, analogous to the lid of a box, by means of which the tentacles and delicate portions of the head may be readily covered over. The lower portion of the animal contains such viscera as are essential to her welfare; she has, moreover, a central tubular membrane, which, passing the siphon apertures of the different compartments, extends completely through the convolutions of the shells from one chamber to another, until it is fastened to the inner wall of the first-formed chamber. And, as if further to strengthen this all-important ligament, around it is a thin layer of horny matter called the belt; and the membrane itself possesses a degree of elasticity which readily enables it to be extended as necessity requires. The creature, therefore, can let herself down, and whirl round and round, as it were upon her axis, by the limited extension of this membranous pulley; which operation, however, ceases when

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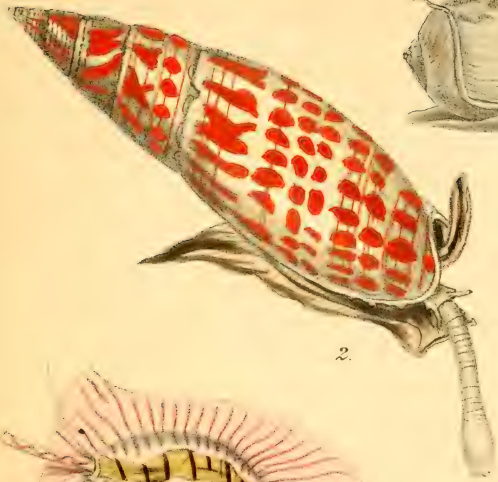

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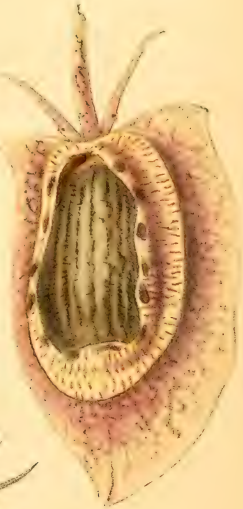

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W.Wing, lith..

Reeve & Nichols, imp.

she arrives at maturity, and the membrane, being no longer wanted, most probably decays.

Such, then, is the conformation of this wondrous creature. As regards the forming of her shell, she is conjectured, when in embryo, to construct a simple hollow shell, the nucleus of a spiral coil, from which she partly emerges; and, in order to fulfil her destination, she divides the empty portion of her dwelling into compartments, between each of which she forms a calcareous partition-wall.

The natural position of a *Nautilus* is with the back of her head and concavity of the hood against the chambered portion of the shell; the funnel resting on the outer concave lip, the tentacles protruded over the side-margins of the aperture, and the body retained within the shell by the membrane and its horny girdle. Thus constructed, the creature makes her way along the sandy bed of ocean with a moderate degree of rapidity, carrying her boat after the manner of a snail; and though in general remaining tranquil in her watery haunts, she has undoubtedly the power of rising and floating on the surface.

Poets have sung concerning her sails and oars, that to her belongs the power of unfolding the one at pleasure, and of using the other with which to impel her fairy boat:—

"The Nautilus and the Ammonite
Were launched in storm and strife;
Each sent to float in her tiny boat
On the wild, wild sea of life.

"And each could swim in the ocean's brim,
And anon its sails could furl;
And sink to sleep in the great sea deep,
In a palace all of pearl."

Pope, in like manner, when recurring to the earlier condition of society, assumed that man first learned the art of navigation from the Nautilus:—

"For thus to man the voice of Nature spake:
Go, from the creatures thy instruction take;
Learn of the little Nautilus to sail,
Spread the thin oar, and catch the driving gale."

Recent observations have, however, dissipated the illusions of past ages and the fantasies of poets. But although the *Nautilus* has neither sails nor oars, she is enabled to rise from her dwelling in the fathomless abyss, and to float on the surface of the water.

"No star has she to guide her way,
Nor Tyrian cynosure."

Yet still she saileth on, progressing without chart or compass, and, undeterred by the perils of the deep, propel-

ling her mimic vessel by the most simple and expeditious means,—that vessel which no human hand has formed—guided by no human skill: a striking proof, amid the terrors and the wonders of the ocean, that, whilst nothing is too great for the controlling powers of Omnipotence, nothing is too humble for his protecting care.

The human mind, even when unassisted by the light of revelation, could arrive at this conclusion; and hence, not only trees and flowers, nay, even the most curious shells were supposed to be under the control of, and peculiarly favoured by some presiding Deity. Thus, while in Syria the *Buccinum* was anciently dedicated to Astarte, in Greece the elegant Chambered Nautilus was peculiarly the care of the famous Egyptian priestess, Arsinoë, who was worshipped as a goddess, under the names of Zephyrites, Venus, and Chloris; a fact which Callimachus has recorded in the following beautiful lines, wherein he commemorates the dedication of a Nautilus to this supposititious deity by Silenœa, the daughter of a nobleman of Smyrna:—

A sacred shell, Zephyrites divine,
Fair Silenœa offers at thy shrine;
And thus thy Nautilus is doubly blest,
Since given by her, and still by thee possest.

Of late, small tackling from my body grew,
Thin sails I spread when winds propitious blew;
But when the seas were calm, to gain the shores,
I stretched my little feet, like lab'ring oars,
And, from my busy limbs and painted side,
Was called a Polyp, as I stemm'd the tide;
Till driven by winds on Coan rocks I shone,
And now recline before Arsinoë's throne.
Depriv'd of life, no more on seas I rest,
Or draw young Halcyons from the watery nest;
But be this boon to Clinea's daughter given:
A virtuous maid, and fav'rite of high heaven;
The precious boon may Silencea gain,
When she from Smyrna ploughs the watery main.

We learn from this beautiful little poem that the Nautilus was not only supposed to feed on the eggs of the halcyon, or kingfisher, but that the appearance of these birds upon the waters was considered a favourable omen; Silencea therefore propitiates the goddess, that she may be indulged with the sight of them during her voyage.

The shell of the Pearly Nautilus has been an object of great interest since the period of its first discovery: at one time dedicated to the Egyptian priestess, at another preserved as a most precious treasure, on account of its surpassing beauty. It is made into a drinking-cup by the inhabitants of the East, and curiously engraved with various

devices; having first removed the outer coating, and thus rendered visible the pearly substance of the shell beneath. An exquisite specimen was exhibited among the curiosities of Fonthill. The decorations were executed in the first style by Hillican; the subject was the triumph of Neptune and Amphitrite. It was elegantly mounted in silver gilt, embossed, and decorated with finely-engraved shells, with masques and Cupids, and a coat-of-arms and helmet, beautifully pierced and worked in gold.

Shells of the Paper Nautilus are equally curious and interesting as those of their relative the Pearly Nautilus; but although the occupants of both belong to the same class, their habitations are very different. That of the Pearly Nautilus presents a somewhat elaborate structure; it forms a strong protection to the soft parts of the animal, and is partitioned into chambers,—a simple mechanical construction, yet wonderfully adapted to assist the specific gravity of its inhabitant. That of the Paper Nautilus, on the contrary, is merely a light elastic case, constructed by the female of a shell-less Cephalopod for the reception of her eggs,—a marine cradle, which presents a beautiful adaptation of means to a desired end.

This marine cradle is not moulded on the body of its

constructor, but deposited from without, with little or no attachment to the animal; a fact which led to the supposition, that the inhabitant was merely a parasitic intruder, which appropriated this kind of shell to her own use, when the lawful owner was either absent or else unable to defend his rights. But at length the real condition of the mollusk was ascertained by the united observations of M. Rang and Madame Power, a lady resident at the port of Messina. Having captured a number of Argonauts, and kept them alive in a large cistern, she observed, not only that eggs were deposited within the shell, but that when, after the lapse of twenty-five days, young Argonauts emerged to life, in twelve days more the two front arms became dilated at the extremity into a pair of membranous webs, and commenced forming a thin filmy shell. The front arms are, therefore, analogous in their calcifying qualities to the mantles of other mollusks; and when the creature begins to form her boat, she expands the membrane, and deposits a thin wavy layer of shell matter, working somewhat slowly, yet very surely, till she has moulded a symmetrical boat or car, for the reception of her eggs. M. Rang relates that he saw several living Argonauts whilst rowing in the port of Algiers, all of which had their arms extended to the sum-

mit of the keel, thus forming a kind of bridge over the cavity that contained their eggs, their prominent eyes glancing in all directions, while their suckers corresponded to the tubercles, and the membranes, expanded over the shell, gave an impression of quiet enjoyment. While looking at them, and observing their progress through the water with their shells foremost, he was led to the conclusion that their movements were produced, not by an exertion of the arms, or any expanding aloft, as sail, of their membranous webs, whereby to catch the breeze, but rather by inspiring and rejecting water, in and out of the branchial cavity; the shell meanwhile being firmly grasped in the embrace of the expansile membranes. And thus, as regards this interesting species, have recent discoveries served to dispel the poetic illusions of past ages, which ofttimes delighted us in childhood. With regard to the animal inhabitant of the *Argonauta*, there is reason to believe that she is extremely sensitive of danger; that any alarm causes her to withdraw her arms; and that when thus thrown off her guard, she has great difficulty in maintaining her hold. Should this occur, and the terrified creature becomes disengaged from her vessel, she cannot re-enter the home which she has so elaborately constructed, to resume the guardianship of her

eggs; she may float about for a short time, and look wistfully at her pilotless bark, but presently the waves overwhelm her fragile form, and she sinks in the abyss.

Farewell, beauteous Mollusk, the Deep's fairest daughter!
Thy dirge faintly soundeth from out the dark sea;
From the halls of the Nereids, far down in the water;
And sad are my thoughts, O thou lost one, of thee!

'Mid the sparkle and flash of the waves scarcely heaving,
'Mid the seas of the Tropics, when far off from shore,
I have seen thy small bark; and the poet's fond dreaming,
Seemed true, as he sung from old Tiber's green shore.

The sea-stars had lit up their coral-paved dwelling,
And the Nereids looked forth by their light o'er the sea;
They watch'd for thy bark, as the waves, proudly swelling,
Floated back from our shores in their triumph and glee.

But they bear thee not now, and the Nereids are weeping,
Lest thy tiny bark gladden their wild haunts no more;
Yet still their fond watch the bright sea-stars are keeping,
And the conch of the Triton is heard as of yore:

That the music and stars, 'mid the rush of the wild waves,
May guide thy frail bark through the night-glooming sea.
But, alas for the Nereids, who watch in their sea-caves,
The bark and its pilot they never may see.

Concerning the *Spirula,* naturalists spoke in former times without any reference to its occupant. A small spiral shell found on the shores of New Zealand excited their admiration,

and those who passed by might linger to observe the singularity of its construction; but not till the days of Peron, an enterprising voyager, who collected and brought to Paris a mutilated specimen, was anything known of its animal inhabitant. True it was that the tentacles were broken off, yet sufficient still remained to assist Lamarck in establishing the relation which its chambered shell suggested with the *Nautilus*. Since then other specimens have come from abroad; and one, brought by the indefatigable Cranch, equally associates his name, and the ill-fated expedition of which he formed the brightest ornament, with this interesting species.

The construction of this little Cephalopod recalls to mind both the Cuttle-fish and Argonaut. Like the former, he has numerous arms, and like the latter, two tentacles, about five or six times the length of his arms, and terminated by a small rounded, indented club. The suckers are sprinkled in a somewhat irregular manner over the inner surface of the arms, whereas in the Argonaut they are arranged in a double row; they are, moreover, very small, and resemble a sprinkling of coarse sand. The Spirule, like the Nautilus, has a chambered, siphonated shell; but here the similarity ends, for instead of being external, and serving as a protection to the inhabitant, it is internal, imbedded within the

lower part of the mantle; and the siphon, instead of passing through the centre of the chamber, is on the inner side. Strange it seems that the shell should be found in such abundance without its occupant,—a fact confirmed by Dr. Hooker, the enterprising botanist of the Antarctic expedition, who relates that he saw thousands of the Spirule shell scattered on the shore at Paroah bay, New Zealand. M. Menke also describes them as frequent on the coast of New Holland. The shell is not dependent on the attachment of a muscle, like the Nautilus, nor on the prehensile embrace of a pair of arms, as in the Argonaut; and hence the soft parts must apparently decompose before the shell can be released.

Cicero refers to the ocean and its inhabitants as affording irrefragable proofs, in connection with the general order of creation, of the existence of a presiding Deity. "How beautiful," says this enlightened heathen, "is majestic Ocean! How delightful to contemplate its vast expanse of waters, varied with islands and continents! How innumerable and diversified the multitudes of living creatures which it contains; some dwelling in its deep recesses, others sporting on the waves, others, again, adhering to the rocks! Who can observe the beauty of the universe, the order of the celestial bodies, the rising of the sun and moon, and

the motion of the stars, without being convinced that the world was not formed by chance,—that God alone is able to be the creator and director of so many wonders?"

This heathen philosopher, and his equally unenlightened countryman, the eminent natural historian Pliny, delighted to acknowledge in their works the shadowy forms of Pagan superstition, which they supposed to control, not only the passing events of life, but also the varied wonders of creation. They brought to bear upon the subject, which engrossed their profoundest contemplations, all the feeble light which they possessed. They regarded, as through a darkened glass, the dispensations of all-ruling Providence, and faintly looked up to the Parent of gods and men; and shall we, who walk in the clear light of the gospel dispensation, refuse to acknowledge Him, who framed this well-ordered world,—who spread the firmament, as a tent to dwell in,—and who gives to his own glorious heaven all its unutterable joys and splendours, which no mortal eye could steadily behold? Shall we be ashamed to avow, that once, travelling in human form, He entered this magnificent museum, and sojourned among the wonders which His hand had made, to reveal at once what God is, and what man ought to be? Heathens might discover an eternal power,

a surpassing wisdom, an undefinable benevolence, in the signs and wonders of creation. Heathens might acknowledge a stupendous liberality in the economy of the whole fabric,—in its garniture, and astonishing accompaniments for the use of man; but the Christian philosopher should ever bear in mind his forfeiture of them, and the price paid to redeem them; he should accustom himself to receive the gifts of a benignant Providence, as from the hand of an indulgent Mediator.

CHAPTER V.

Class II. GASTEROPODA.

Painting and poetry are most glorious gifts,
Which God hath given, with their sweet sister, Music,
To cheer life's pilgrim. Earnest, methinks, are they,
Of high things yet to come, when earth shall cease
Her groanings for deliverance. Nor less pure
Is that calm, inexpressive love of nature,
Which leads the enthusiast to the green hill's side,
Or streamlet's bank, or by the billowy shore,
Lingering and listening to the sea-bird's cry,
Or winds contending round the cliff storm-bleached,
Making a solemn concert with the billows,
That ceaseless come and go; great Nature's pulse.

Cicero, whom Seneca designates as a genius equal to the majesty of Rome, draws a delightful picture of the rural occupations of Scipio and Cælius, at Caieta and Laurentum, when, retired from the restless pursuits of interest or ambition, they grew young in their amusements, and again

derived pleasure from gathering shells on the sea-coast. Cranch too, the elegant and scientific explorer of the Congo, delighted in the same pursuits. Neither difficulties nor dangers impeded his researches. He climbed rugged precipices, and was frequently lowered down by the peasants from the summit of tall cliffs. He waded through rapid streams, explored the beds of muddy rivers, and sought the deepest recesses. He would even relinquish the comforts of domestic life, and venture out to sea, at Dawlish, for several days, entirely alone, or in the small skiffs of the fishermen; employing his time in dredging when the tide was full, and examining the coast when it was out. At night he slept in his boat, which he drew to shore; and when the weather was too stormy for marine excursions, he would leave his little skiff, and explore the woods and fields, for birds or insects. No inclemency of weather, nor alternations of storm and sunshine, ever interfered with his favourite pursuits; the discovery of a new shell, or bird, or insect, amply repaid the most hazardous exertions.

Previous, however, to enlarging further on the localities of shells and their extraordinary beauty, it will be needful to speak concerning the distinctive characteristics of the second class, the Gastropods, comprising an extensive series

of mollusks, of which the typical structure is that of a long and conical mass, partly contained in an enlarged spiral shell, which protects the soft and visceral portion; partly protruding, in its broad extremity, from the aperture of the shell, and comprising the head and mantle, the nerves and gills and muscles, with a broad, fleshy, muscular, expansile disc, mostly attached to the neck, which acts the part of a foot, and alternately contracts and dilates.

These creatures are extremely numerous, and of considerable interest. They present extraordinary varieties of form and colour; of sculpture also, for their domes are elaborately carved and adorned; and their diversity of habit is equally remarkable. The greater number are marine, and yet colonies abound in lakes, and stagnant pools, and rivers, dwelling also on land or climbing trees; and as their breathing apparatus is necessarily adapted to the places they inhabit, the respiratory organs, together with certain modifications in their arrangement, are selected as characters, whereby to distribute the class into orders.

Such is the merest outline of this interesting class. Let us consider the further peculiarities of their structure.

In Gastropods, the head forms the outer extremity, and is mostly rounded and prominent; it possesses from two to

six tentacles, or feelers; and the eyes, which never exceed two in number, are situated either at the base of the tentacles, or at the summit, or some intermediate part. These tentacles are somewhat sensitive to the touch, and in the Snails the mollusk withdraws them by inversion, for which purpose a nerve reaches internally to the summit.

Three ranges of cords represent the nervous system of the Gastropods: the first pertaining to the head, the second to the mantle, the third to the gills, each with its assigned office, either as regards the well-being of the animals or the place it is designed to occupy.

The breathing apparatus consists, in those which inhabit water, of two or more branchiæ, or gills, either concealed or exposed; in such as dwell on land, or inhabit trees, it consists of a net-bag or lung; in those which are amphibious it presents a modification of both. Some few of the marine species feed on sea-weed; but more generally they are carnivorous, preying ofttimes upon their brethren, or fulfilling the same office in the water, as jackals and hyenas, Nature's scavengers, perform on land. Most of the terrestrial kinds are herbivorous, for which purpose they are furnished with a horny armature on the upper lip only; carnivorous mollusks, on the contrary, are provided with a rasping plate or tongue,

or a pair of finely toothed jaws, or a flexible trunk, which admits of being lengthened or drawn within the body, the extremity of which is cleft and supplied with numerous small recurved teeth capable of considerable execution. The common Whelk offers such an instance of the retractile trunk; and the circular hole found drilled in bivalve shells is due, most probably, to its destructive agency.

Concerning the muscles, it will be necessary to speak of such only as serve to attach the shell. In simple univalves, the muscle of adhesion sometimes encircles the back in the form of a horse-shoe. This peculiarity is conspicuous in *Fissurella*, while in the Cup-and-saucer Limpet, *Calyptræa*, it is attached to the cup-like appendage which distinguishes the group. In such as are spiral, the shell is concealed by a thin, riband-like muscle, attached to the axial pillar or columella, by the elasticity of which the animal advances its head and foot, when need requires, and again retires within the last whorl. Instances, however, are not wanting, where a spiral Gastropod, desirous to relinquish a portion of his shell, has the faculty of sliding the attachment of the columnar muscle without relaxing it, in a manner analogous to the slipping of the muscular girdle in a growing Nautilus.

Other contrivances are obvious, in different kinds of mollusks. The *Bulimus decollatus*, and many species of *Pupa*, allow the early portion of their shells to fall away,—a poet perhaps would tell you, for the pleasure of roofing over the whorls by new concentric layers; and doubtless the creatures take much delight in varying and adorning the fairy-like domes in which they dwell. Why else does the *Magilus*, that singular tenant of the coral rock, fill up the deserted portion of his shell with testaceous matter; or the *Cowry* adorn his dome-shaped dwelling with the most exquisite embellishments?

An additional muscle further belongs to such species as possess an *operculum*, for the purpose of drawing that appendage within the aperture. The *operculum* is a shelly or horny plate, adapted in most species to answer the purpose of a door, by closing the aperture of the shell; occasionally, however, it is merely a small, thin, horny plate, of which the object is unknown.

A low degree of sensibility belongs, apparently, to all Gastropods. Some species are even capable of reproducing any member, when accidentally destroyed. Some, also, remain torpid for a great length of time; and an instance is recorded in the 'Elements of Conchology' of some *Helices*

having been received from a distant locality and kept in a dry lumber-box for two years, after which they revived from their torpid condition when placed on a moist fresh leaf. And yet, however deficient in the sense of feeling, all Gastropods exhibit great ingenuity in repairing any injuries done to their shells; and considerable skill is exercised in absorbing or smoothing down such spines or irregularities as disarrange their plans or obstruct their growth.

It seems, also, as if they liked to exercise their ingenuity in constructing nests, or cradles, for the reception of their eggs. Who does not admire the nest of a small bird, framed of leaves and mosses, and curiously lined with feathers? But not less ingeniously formed is the nest of the tree-loving *Bulimus*, which cements together a little cradle of leaves for the reception of her beautifully white eggs, which are nearly as large as those of a pigeon. The Whelk deposits her eggs in thin, bladder-like capsules, curiously wrought together; the *Turbinella*, in a long chambered nidus, in each compartment of which are from twenty to thirty embryos; and the *Ianthina* encloses her little progeny in a delicate film-like bag, which she attaches to her curious float; this done, and having securely fastened their several cradles, or nursery cells, she detaches the float, which rapidly ascends

to the surface of the water, and thus exposes the ova to the full influence of solar light and heat.

The science of Conchology continually presents fresh subjects of interest to its votaries; and as regards the general habits of the Gastropods, many interesting phenomena have become developed. The greater number attach themselves to marine rocks, or masses of stone; they also creep into cavities and crevices, and hide in tufts of coral, or among sand and mud. The *Magilus* even fixes his stationary abode in a growing mass of white coral; but then, in order to maintain a necessary communication with the surrounding element, he alters his spiral mode of growth in accordance with the increase of the coral, and pursues a nearly straight course, in order to keep pace with the advancing surface of his rocky bed. The *Ianthina*, or Sea-snail, and the *Stylifer*, are equally deserving of brief notice: the first, a creature that floats on the bosom of the ocean by means of numerous air-bladders affixed to the foot; the second, of parasitic habits, living imbedded in the soft parts of the Star-fish.

Shells belonging to the class of Gastropods are either of a spiral or conical structure. Among these the first are most numerous, though without including any specimens of equal weight and dimensions with the Giant Clam of Bivalves.

The typical structure is that of an enlarging conical tube, winding obliquely from left to right, by reason, probably, of some peculiar tendency in the vital organs of the animal. The axis upon which the tube winds, is called the axial pillar, or *columella*; every turn round this axis is termed a *whorl*; and when the columella is hollow, it is said to be *umbilicated*. Modifications exist in different species; and while some convolutions are extremely simple, others are elongated or depressed. Of this, the shell of the *Caracolla parmula*, which is so much flattened in its spiral tube as to present the form of a slightly convex lens, offers a familiar instance. The form of such as pertain to the second division varies, from the deeply depressed cone of the *Umbrella*, to the extreme conical elevation of *Dentalium*. In one genus, *Chiton*, the shell consists of eight distinct pieces, moving one upon the other within a cartilaginous frame, and bearing no small resemblance to plate armour. In the *Aplysia*, the shell is merely represented by a concealed horny plate, deposited by an internal fold of the mantle. There are likewise shell-less members of the same community, called *Nudibranchiata*, or Naked-gilled Mollusks, which present beautiful varieties of tufted and ramified structures along their backs. They afford no ornaments for the cabi-

net, and, therefore, are rarely sought for; but their varied forms, and adaptation to their native habitats, are among the wonders of creation.

The land species of such mollusks as belong to the class Gasteropoda, offer extreme modifications of depressed growth. The reasons of this are obvious :—their visceral portions are contained within a smaller space than those of their carnivorous brethren; they have no occasion for teeth and rasped plates, nor a complicated digestive apparatus. It is otherwise with the flesh-eating tribes, and hence they have greater powers of shell-making. A ponderous, massy shell is often the production of an animal which apparently does not require such a spacious mansion; but, though large, they have no external ramification, when constructed by terrestrial species, and little variety of sculpture; whilst such as inhabit the water beautify their homes with ribs and tubercles, with plates, and spines, and fronds.

Seven distinct orders belong to the series of Gastropods, each of which are characterized by varieties in the respiratory organs :—

Order I. PECTINIBRANCHIATA.—Including numerous mollusks, of which the *branchiæ*, the gills or breathing apparatus, are arranged for the most part in parallel

laminæ, like the teeth of a comb, and are contained within a cavity in the upper part of the neck. Some of the tribe are carnivorous; others, herbivorous. The former are universally distinguished by a siphon, or siphonal appendage passing out of the basal channel of the shell, for the purpose of conveying water into the branchial cavity.

II. PULMOBRANCHIATA. — This order includes the whole of the pulmoniferous, or air-breathing Mollusca. Their respiratory organs form a kind of vascular net-work, lining a cavity in the back; while the mantle is perforated in that part which covers it, the orifice being furnished with a small fleshy valve, which the animal opens and shuts at will.

III. PLEUROBRANCHIATA.—Distinguished by the gills being situated on the right side.

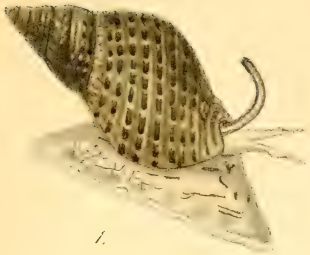
IV. CERVICOBRANCHIATA.—With gills situated in a special cavity in the neck.

V. CYCLOBRANCHIATA.—Gills placed in a circle round the edge of the body.

VI. CIRROBRANCHIATA.—Cirrous, or hair-like gills.

VII. NUCLEOBRANCHIATA.—Comprising a class of mollusks which exhibit a very distinct peculiarity of organization.

Their feathered branchiæ are enclosed in a nucleus, protruding from the back, and covered in one or two instances with a transparent glassy shell. The central disc is represented by a gelatinous fin, and the animal, scarcely ever at rest, swims with considerable activity.



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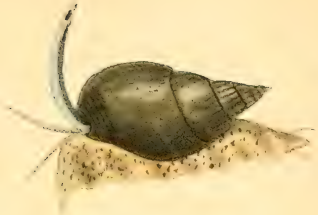

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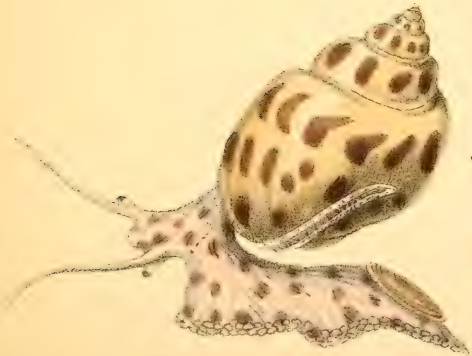

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W. Wing lith.

Reeve & Nichols imp.

CHAPTER VI.

FAMILIES OF PECTINIBRANCHS.

Oh, for an eye to scan the depths of ocean;
To note where dwell those strange and wondrous forms
Instinct with life, that work in caves,—it may be
Where sunbeams wander never; nor soft airs,
Breathing perfumes from clover-fields at evening,
Shed fragrance as they pass.

We now proceed to the consideration of different shells that pertain to the Gastropod class, with especial reference to their molluscous inhabitants, and the exquisite variety of form and tinting which are wrought or painted by those artists of the ocean.

Family I. Convoluta.

This family comprises an interesting series, in which the whorls of the shell are convoluted one over the other, without obliquely descending, so that the sutural extremity remains almost upon a plane with the top of the spire.

Among the most interesting of these are the Cones, whose similarity of form constitutes a natural and well-defined group; for any difference of structure consists chiefly in the depression or elevation of the spire, the thinness or inflation of the whorls, and in the spiral edges being either plain or coronated. Striking variations, however, occasionally happen; and it must be borne in mind, that such are common to different individuals of the same species. Some, for example, are found with the spire at one time plain, at another, coronated; and the surface of many, in like manner, is either smooth or granulated.

The Cones mostly inhabit deep water, and nearly all are tropical; they essentially require a warm region, and hence only one or two are found so far north as the Mediterranean. Like all tropical Fauna, they present a vivid colouring, and their decorations are of exquisite workmanship. The molluscous inhabitant of the *Conus gloria-maris*, or the Glory of the Sea, is, apparently, endowed with an astonishing ingenuity of design. The white ground of its turbinated and cylindrical shell is covered with the finest possible triangular lines, of a delicate dull reddish hue, and encircled with blotched bands of exquisite tinting. The Orange Admiral Cone, *C. aurisiacus*, zoned with white and rose-colour, and

tesselated with white, crimson, blackish, and brown spots, and the *C. imperialis*, or Imperial Cone, encompassed with yellow and chestnut bands, and varied on its surface with purple black dots and solid lines, stained here and there with blue, exhibit the most elaborate painting. And hardly may the finest specimens of gold brocade equal the Cloth-of-Gold Cone; or the most careful productions of the loom, such elaborate meshes as are seen in the Abbot, or Queen Victoria Cone. The *Conus mercator* is distinguished, also, by an elegant net-work, composed of faintly waved, yellowish lines; the Purple Cone, *C. purpurascens*, is encircled with fine purple and white necklaces; and vivid hieroglyphic spots, with three orange zones, embracing the upper, lower, and middle portion of the shell, distinguish the Letter-marked Cone, *C. literatus*.

Cones have the siphon in general much elongated, and curved upwards and backwards over the shell; the head somewhat projects, and is furnished with a retractile proboscis, in some instances situated on the outer side near the extreme end of the tentacles; in others, in the middle; in others, even at their outer bases. The creatures themselves are often handsomely marked and marbled; but more generally are less brilliant in colour than the shells which they inhabit.

The genus becomes more numerous and varied in colour as we approach the equatorial seas. Mr. Adams relates that they seem to prefer fissures and holes in marine rocks, especially among coral reefs, living in warm shallow pools within the barrier, where, although slow-moving, they lead a predatory life,—robbers of the ocean,—that bore into their neighbours' shells for the purpose of extracting the juices on which life depends. They crawl but slowly, and usually with their tentacles in a straight line before them, and yet, though robber-like, are very timid, and shrink within their shells on the approach of danger. Some affect deep water; and one was dredged by the naturalists of the Samarang, in the Sunda Straits, in thirty fathoms; another, the *Conus thalassiarchus*, at Sooloo, in about forty fathoms.

This beautiful genus predominates in the Asiatic region, where upwards of one hundred and twenty species are ascertained as peculiar; while only two or three are known in Europe, about twenty in Africa, thirty in Australia, and fifty in America. Some few are venomous; the *Conus aulicus* —with its beautiful proboscis of red and white—is capable of inflicting a severe bite, accompanied by sharp pain, making a small, deep, triangular mark, succeeded by a watery vesicle. Sir Edward Belcher was bitten by one of these

Cones, at the little island of Mayo, belonging to the Moluccas, near Ternate. The creature, on being taken from the water, suddenly darted forth his proboscis, and made an incision in the hand by means of his tongue, which is long and armed with two ranges of sharp-pointed teeth. The pain produced by this sudden wound resembled that which is occasioned by phosphorus.

The Cowries, pre-eminent in interest and beauty, whether as regards the animal or shell, present two distinct groups: the larger, in which the surface of the shell is highly enamelled; and the smaller species, in which it is disposed in grooves and ridges, of more opake character and delicate texture. They offer little variety of form, but a diversity of colouring; and among them are several very distinct and characteristic species, of unusual rarity. Of these, the *Cypræa princeps* and *leucodon*, in our national collection, are perfectly unique, and may be regarded as being among the most valuable shells yet discovered.

Others of the same family exhibit the most exquisite fantasies of embellishments. The Arabic Cowry is distinguished by lines of hieroglyphics, which cross the dorsal surface from one extremity to another; a miniature firmament of stars, of different degrees of magnitude, with curious sand-

like striæ, characterize the little Calf Cowry; the Red-spotted is ornamented on each side with a single reddish-chestnut spot; and a beautiful economy and delicacy of bright sienna painting, upon a clear cream-coloured ground, renders the *C. Saulæ* an object of peculiar admiration. Lastly, the rare and beautiful Orange Cowry, worn as an ornament by chiefs in the Pacific islands, is distinguished by its bright, unspotted, orange teeth and interstices, while the base and sides, and extremities are milk white.

The *Ovula*, or Egg-shells, also belong to the family of *Convoluta*, differing mainly from the *Cyprææ* in having the extremities more or less prolonged, and in the lip and columella being destitute of the prominent row of teeth which characterize that genus. Another distinction consists in the *Ovulum* having neither any pattern nor design of colour, nor has it any tinge beyond a faint yellow, violet, or pink.

A distinguished conchologist of Nice, M. Risso, founded the genus *Erato*, with a small shell, chiefly inhabiting the Mediterranean, intermediate in its characters between *Cypræa* and *Marginella*, and forming a striking link between the families *Convoluta* and *Columellata*.

Family II. Columellata.

The shells are beautiful: look well upon them,
And think no longer that they sprang to life,
As radiant flowers unfold at dawn of day,
Instinct with beauty. Dwellers in the shells
Have wrought these wonders.

The *Columellata* are characterized by four or five conspicuous plaits winding obliquely round the columella, with a notch at the base, or rather front edge of the shell, when viewed in its natural position upon the animal, for the passage of the respiratory organ.

Five genera belong to this family.

The animal inhabitant of the large Melon shells varies from that of *Voluta* in the size and extensive muscular expansion of the disc; the shells are, moreover, distinguished by their light inflated growth, and sunken papillary spire, around which the whorls are elevated, with their summit sometimes concavely flattened, sometimes coronated with a diadem of vaulted scales. One or two species are found in Australia; but the chief portion are from the coast of Africa. They burrow in the sand at low water, and live mostly concealed from view.

In the new and beautiful monograph recently published by Mr. Reeve, of which that gentleman has permitted me to avail myself, the Volutes are admirably figured, and largely described. This genus, termed by an accomplished writer the nobles of *Testacea*, as Linnæus, in his admiration of exotic palms, called them the princes of the vegetable world, has ever been a favourite with shell collectors. Only seven species were known to Lamarck; but recent conchologists have ascertained at least sixty-one species, as also that the geographical range of the Volutes is peculiarly Australian. The extending of our empire, therefore, into that distant portion of the globe, of which the fauna and the flora are singularly distinct from those of other regions, has given to the English collector a decided advantage in obtaining species and varieties, of which many are extremely rare.

Volutes uniformly present an agreeable variety of form and lively arrangement of colour; and in reviewing the various modifications of character, our attention is naturally directed to the most permanent feature of the genus,—the plaits of the columella. These are mostly four or five in number, strongly developed, and winding round the pillar somewhat obliquely, yet occasionally reduced to two or three,

varying slightly in different individuals of the same species, and even exhibiting four or five strong plaits, with several finer rudimentary plaits in addition.

Somewhat of inconstancy pertains also to the form of the Volute; the same species being at one time elongately convoluted, with the spire proportionably exserted; at another, shorter and contracted, as also either smooth or tubercled, just as a Cone is smooth or granulated; and the closer and more contracted the growth of an individual, the thicker and more prominently is the shell raised in tubercles.

"The most decided characteristics for the distinction of species are to be found in certain parts of the shell, such as the apex and the base, with the general contour of the body-whorl, and its texture and substance, the outline of the aperture, and, above all, in the general design of painting. However much a species may differ in its plan of convolution, the parts referred to are the same; and however variable a species may be in colour, there is but one idea in its pattern and manner of distribution. There is more constancy in the pencil of the Volute than in the colours of its palette."

In most species the apex is blunt and papillary; that is, the first two or three whorls, constituting the nucleus of the

shell, are smooth and polished, forming what has been termed a *papilla*, before either a pattern or sculpture is developed. Mr. Reeve has adduced various instances of modification in the apex: he mentions that such are uniformly accompanied with distinctive features in other parts of the shell, serving to characterize groups, and divide the genus into subgenera or sections; that, further, except in the small *V. abyssicola*, the only living representative of a group of fossil species found abundantly in the Tertiary beds of Great Britain, there is no transverse sculpture in this genus.

Linnæus included under genus *Voluta* all shells having a row of plaits winding round the columella, without considering the nature or habits of their animal occupants. Conchologists of the present day have rectified this error by separating such as were originally, and in the infancy of science, comprehended under the same generic type.

The occupant of the *Voluta* differs little from that of the *Cymbium*, except in being smaller, less expansile, and more richly tinted. It has the same peculiar lobed dilation of the respiratory siphon, and the eyes, as in that genus, are rather distant from the tentacles. The living species hitherto figured are brilliantly coloured; but there is no similarity between the colour or pattern of the animal and its shell.

The geographical distribution of the Volutes is noted by Mr. Reeve as worthy of careful attention. Of sixty-one species at present known, twenty-four inhabit the coast of Australia. Throughout the great Eastern Ocean, spreading from Java to Japan, only twelve are found; seven are from different parts of the coast of Africa, including Madagascar; six from South America, east and west; and four inhabit the West Indian Seas and the Gulf of Mexico. The locality of the remaining eight species remains unknown.

It is, therefore, obvious that the Volutes have peculiarly a southern range. Only sixteen species are found north of the equator, whilst there are thirty-seven in the southern hemisphere; two of which, *V. Magellanica* and *ancilla*, of large size, inhabit the coast of Patagonia and Tierra del Fuego, in the same parallel of latitude with Scotland and Hudson's Bay, in the opposite hemisphere. Yet the Volutes do not approach the Mediterranean, or any part of Europe; and very curious is the fact, that the fine and beautifully coloured *V. musica* is the only species found in the West Indies, excepting the small *V. Guildingii*. An equally small species, the *V. guttata*, allied to this, inhabits the coast of Honduras; and it is believed that the celebrated *V. Junonia*, of which only a few specimens are known, is

from the Gulf of Mexico,—probably the northern shore, near the mouth of the Appalachicola river. Only two species have been found on the western coast of South America, *V. harpa* and *Cumingii*; and concerning the African species, their precise localities are unknown, excepting that of the *V. Delessertiana* of Madagascar, and the beautifully cancellated *V. abyssicola*, dredged from a bank of dead shells and iron-stones, at the depth of one hundred and thirty-two fathoms, off the Cape of Good Hope.

Such are the distinctive characteristics and geographical distribution of the Volutes; among which, the Magnificent Volute, *Voluta magnifica*, is of a light fulvous colour, clouded, and more darkly broad-banded with rusty chestnut, having transverse lanceolately-angled pale spots; columella orange-carnelian.

The eminently beautiful *Voluta aulica*, or Courtier Volute, has been known for many years, by a specimen contained in the celebrated museum of the last century, belonging to the Duchess of Portland. It is described in the 'Portland Catalogue' by Dr. Solander, a Swedish naturalist and pupil of Linnæus, who visited this country, and accompanied Sir Joseph Banks in his voyage round the world with Captain Cook, and who subsequently was em-

ployed at the British Museum in arranging the valuable collections of natural history resulting from their enterprise. And thus has Dr. Solander written concerning the Courtier Volute:—"No. 4021, *Voluta aulica*, a beautiful red-clouded species of the Wild Music kind; its country unknown, unique."

This fine specimen passed from the Portland Museum into that of M. Calonne, then into the collections of the Earl of Tankerville and of Mr. Broderip, lastly into that of our national museum, where it remained unique until the return of Mr. Cuming from his voyage among the Philippine Islands, during which he obtained several magnificent specimens from the Sooloo Archipelago, yet mostly differing from the original one in being tuberculated. Of these, Mr. Broderip characterized six new varieties in the 'Proceedings of the Zoological Society' for 1843; and with reference to his own description of No. 4 *a*, exquisitely figured in the 'Conchologia Iconica,' he remarks, that when considering the novelty and lovely arrangement of colour in this admirable specimen, he felt that description would convey but a faint idea of one of the most beautiful shells he ever saw.

Another species, the *Voluta innexa*, or Knitted Volute, hitherto undescribed, and of which the locality is unknown,

is figured in the same splendid work. The entire surface is covered with a remarkably fine scarlet-brown net-work, very closely arranged transversely, so that the triangular spots of white, which appear here and there, are unusually longitudinal, whilst the three bands, which are somewhat indistinctly formed by a darker deposit of the colour, are unusually narrowed.

Conspicuous, also, is the *Voluta piperata*, or Peppered Volute. The painting of this beautiful species in all its detail is too minute to be rendered faithfully. But the eye rests upon its general form and hue with peculiar pleasure, as figured in the same work. The entire surface is peppered with small orange-brown dots, and over this are numerous rather distant jagged olive-black streaks, running in zigzag style from the sutures to the base. About one-half is partially obscured, at intervals, by three bands of greenish-white film, the pattern being seen through it. The species is at present unique, in the collection of Thomas Norris, Esq.

New and beautiful Volutes, with some of extreme rarity, are figured in the 'Conchologia Iconica,' and, while looking at them, the mind recurs with equal delight and thankfulness to the gift thus given, for transferring the forms and

hues of those exquisite productions, which must otherwise remain in a great degree unknown. Among these, the noble growth and bright scarlet colouring of the Handsome Volute, *Voluta festiva*, are exhibited in drawings from magnificent specimens in the collections of the Rev. W. R. Crotch and Mr. Dennison. The shell is, doubtless, from the coast of Africa, but whether the eastern or western remains undecided. Admirably figured, also, is that eminent shell, the 'Pavillon d'Orange' and Orange Flag of early writers —the Flag Volute, *V. vexillum*, still of rare occurrence, and unapproachable by any other species of the genus. The bright orange bands of painting which characterize the shell mostly become divided, on reaching maturity, into two shreds. Neither can the Angled Volute, *V. angulata*, be omitted. The shell is mentioned as chiefly remarkable from the curious fact, that the animal, which is elegantly spotted all over like a leopard, has a lobe extending from the mantle on the left side, after the manner of a Cowry. It does not, however, secrete a vitrified enamel, but a milky glazed coating, like *Cymbium*, through which the zigzag marking is mostly visible. "In a specimen before me," writes Mr. Reeve, "from Mr. Dennison's collection, the shell is entirely covered with this glazed coating, flowing

even beyond the apex, and the marking is obliterated, whilst the columella and interior of the aperture is of a rich carnation-colour."

M. D'Orbigny observed this species on the coasts of South America, ranging from the mouth of the Rio de la Plata, north of Buenos Ayres, to the Bay of San Blas, in Patagonia, where it lives imbedded in the sand. Having captured a specimen that was advancing from its hiding-place in the water, he kept it alive for several days in a glass vessel, during which time the creature walked about, enveloped by the lobe of its mantle.

The genus *Mitra* constitutes a numerous division of the family *Columellata*, and is equally admired for the symmetry and the variety of colour exhibited in its three hundred and thirty species.

Linnæus arranged the Mitres with Volutes; but Lamarck separated them, on account of important differences, of which not the least obvious is their shell being long and turriculated, with a marked change in the arrangement of the columellar plaits, which, instead of increasing, diminish in size as they descend. The animal is small, the head triangular, with tentacles at the basal corners, and the eyes are situated either towards the middle or the base, upon

short peduncles; the respiratory siphon is small, and not dilated into lobes at the base, and the trunk is capable of remarkable elongation; lastly, their habits vary, and they differ in geographical limits.

Three hundred and thirty species, as already noticed, pertain to the genus *Mitra*; and in these, what infinite variety! No two individuals are alike. Some are beautifully varied and adorned, others are neatly finished. It seems, however, that the constructing inhabitant, although loving to adorn his mansion, is a creature of limited sensibility, and that his powers of locomotion are necessarily restrained by the overbalancing proportions of his shell; or else, that being furnished with the means of lengthening his trunk to an extent not assigned to any other genus, and having the extremity terminated by a kind of dentated chewing apparatus, by aid of which he is enabled to capture his food with little apparent effort, and without altering his position, he prefers to devote his energies to forming an ample dwelling, and adorning it with the most exquisite specimens of art.

The *Mitra Norrisii*, or Norris's Mitre, dedicated by Mr. Reeve to that esteemed patron of the natural sciences, whose magnificent collection of Mitres is, perhaps, un-

rivalled, is covered with a reticulated sculpture, so extremely fine, that the interstices of the net-work resemble minute punctures.

The superb *Mitra Stainforthii*, Stainforth's Mitre, is of a whitish tint, while the base and apex are of an ashy blue, and the ribs painted with square bright red spots.

Observe the beautiful and costly Riband-filleted Mitre (*Mitra vittata*), a yellow or bright orange shell, zoned with white, and encircled with several blackish-brown fillets; the Serpent-marked Mitre (*Mitra serpentina*), recognized by its orange-tinted bands, and the serpentine character of its longitudinal markings; and the *Mitra militaris*, or Military Mitre, which is readily distinguished by the broad crimson-red zone which encircles the last whorl. Nor less worthy of notice is the Modest Mitre (*Mitra modesta*), a very chaste pink-white shell, with a highly relieved latticed sculpture; nor yet the Red Mitre (*Mitra rubra*), a beautiful little semitransparent red shell, which presents a striking contrast to the hard, polished, blackish-brown shell of the *Mitra bilineata*, or Two-lined Mitre, which derives a name from the two distinct yellow lines by which it is encircled. The solid ivory-white *Mitra festa* is also deserving of particular notice, with the Pleasant

Mitre, encircled by a dark band, and the clear pale yellow *Mitra crocea*, or Yellow Mitre, having an orange mouth, as also the *Mitra corallina*, or Coral Mitre, a species, of which some specimens resemble bright amber, and others red coral.

No particulars of interest are recorded with regard to the remaining genera of this family.

Family III. Purpurifera.

> How beautiful, in all their varied forms,
> Are these choice sea-shells,—some of gaudy hue,
> And some of quaint device; and wondrous, too,
> The ocean artists, that with matchless skill
> Have thus devised them.

Shell terminating at the base, either with a short slightly ascending canal, or with a deep sinus; but the only distinguishing character of the family is found in the basal sinus, that posterior portion of the shell which is fitted to the passage of the respiratory siphon, conveying water to the branchial cavity.

Poets have sung concerning the sea-green sisters, and their curious webs, woven beneath deep waters in caves, where grows the coral, and where their warbling voices

are heard in unison with the murmuring sound of waves that come and go; but far more beautiful are the shells of ocean, wrought by those concerning whom no poet has yet sung. Strange, fantastic-looking creatures are they, and yet endowed with faculties for design which an earthly artist may in vain hope to emulate. We have spoken of their exquisite decorations, as shown in the Cone, the Cowry, and the Volute. As respects the inhabitant of the latter, a striking contrast of colour exists, when compared with his habitation: the same peculiarity is obvious in the mollusk of the *Purpurifera*; and the relation of form is equally remote. In that of *Dolium* the animal is green or mottled blue, without the slightest approximating tinge in the shell; he is also characterized by an ample muscular disc, and a remarkable lengthening of the proboscis, terminated in the *D. perdix* by a flattened funnel-like rosette; whilst the shell is chiefly distinguished for its comparative tenuity. The resident in the *Harpa* has a richly coloured disc, extending beyond the outer extremity of the shell, nearly to a peak. In some of the *Buccina* this member is expanded on either side the aperture, and truncated behind into a flat square. In *Oliva* and *Ancillaria* a modification is apparent, which somewhat resembles the lobate structure of the

Cowry, which, being reflected into an ample fold, is able to envelope the whole shell; while the locomotive and calcifying organs are extremely limited in their dimensions, owing to the confined nature of his habitation, although the latter is exercised with a degree of surprising energy.

Twenty-four genera belong to the family *Purpurifera*; among which the *Terebra* and *Oliva*, the *Eburna*, *Bulla*, *Buccinum*, and *Magilus*, the *Purpura*, *Dolium*, *Harpa*, and *Cassis*, are deserving of particular attention.

The animal inhabitant of *Terebra* has a small head and tentacles, and the entire mass rarely extends beyond a tenth of the shell. But, although encumbered with a shell ten times the length of his body, the creature is far more active than his relative the Mitre; his shell, though longer, is not of such overbalancing proportions, and the weight being chiefly at the base, enables the mollusk to move somewhat readily, by the force with which he secures his muscular disc to some contiguous rock or tuft of sea-weed.

Terebræ chiefly inhabit the eastern world, and are restricted to warm temperatures; one small species, only, extending as far north as the Mediterranean.

The enamelled exterior of the Olive-shell indicates that it is more or less enveloped, like the Cowry, with a portion

of the animal; it is not, however, covered by the mantle, but rather protected by a modification of the disc. The mantle itself is limited to the interior and aperture of the shell: it appears to be furled over the edge of the lip, and is held, as it were, in a state of tension by a cord or filament, passing from the posterior extremity into a deep, narrow channel, excavated round the spire of the shell, in place of the suture. The result of this difference in the calcifying organ is extremely curious. In the Cowry the testaceous fluid is deposited from the outside in layers, at different intervals; in the Olive, it is secreted in layers simultaneously at the lip, and the porcellaneous surface of the shell is preserved in its different stages of growth, as well as after its maturity, by a reflection of the ventral disc, in a manner somewhat analogous to the reflected mantle of the Cowry; having nought to do with the formation of the shell, however ministering to its preservation by the tendency of its viscid humour.

Every period in the life of a Cowry, as already noticed, is designated by a different design of colouring. It is otherwise with the Olive, which uniformly exhibits the same appearance from youth to age: different layers of colouring matter must consequently be deposited at the same time,

because the building organ reaches only to the lip, from which the shell gradually recedes in its progress of growth. One and the same purpose is, therefore, effected by different means, which are equally beautiful and curious in their results. But, though the shell of the Olive offers no outward indication of progressive growth, yet, if the outer coat be removed by chemical agency, a superincumbent layer of different colour and design becomes visible. Thus, while the external coating of the *Oliva utriculus* is of an obscure milky blue tinge, a dark ashy ground, sprinkled with numerous triangular opal-like dashes, is revealed by the application of an acid; thus, also, when the outer layer of the *Oliva Brasiliensis* is removed, a longitudinally striped pattern becomes apparent.

Olives are confined exclusively to the tropical regions.

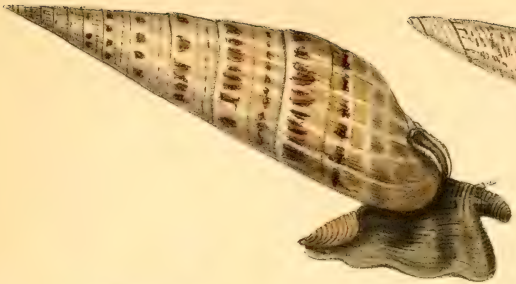
The genus *Eburna* includes a natural, though extremely limited, group of species; and, although a peculiarity of colour is rarely regarded as an element in the character of a genus, it constitutes, in the present instance, a feature which cannot be overlooked. The species are each distinguished by a blotched and tessellated painting of orange-brown, upon a white ground; the apex throughout is black, and the columella and interior of the aperture white.

The animal carries a horny operculum at the hinder extremity of a stout, thick, oval, and pointed disc, that fits exactly to the aperture of the shell. The head is large, bifurcated in front into two elongated tentacles, at the outer base of which are the eyes; the mouth is armed with a cylindrical trunk, and a somewhat long respiratory siphon adds to the singularity of the creature's aspect.

The *E. spirata* and *Zeylanica* are found abundantly in Ceylon; those selected for illustration in the 'Elements of Conchology' are from Japan, and of great rarity.

The Latin word *Buccinum*, a trumpet, was indiscriminately applied by the ancients to every kind of spiral univalve shell. Linnæus adopted the term in a more restricted sense; but we owe to Lamarck a dividing of the *Buccina* into several acknowledged genera.

Larger species of the genus *Buccinum* are still used by Italian herdsmen in directing the movements of their cattle, and a variety of sonorous sounds may thus be readily produced. They are also common in North Wales, where I have often heard their deep and hollow sounds breaking on the silence of those alpine districts, when used by the farmers in calling to their labourers. Triton, Neptune's trumpeter, is generally pictured with a shell of this de-



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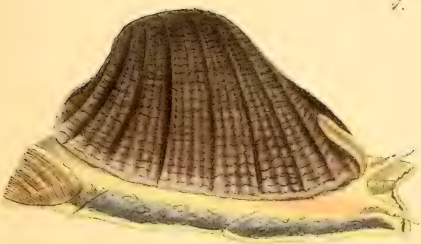

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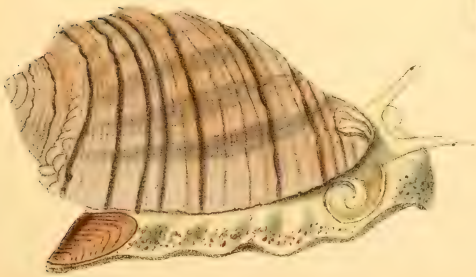

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W. Wing lith.

Reeve & Nichols, imp.

scription in his hand, with which ancient poets fabled that he convened the river deities around their monarch. It is wreathed, like those called *Sikanos*, or Sea-horn, common to India, Africa, and the Mediterranean, and still used as trumpets for blowing alarms or giving signals; a custom thus elegantly noticed in the following lines :—

> "When the roused youth impatient flew
> To the tower wall, where, high in view,
> A ponderous sea-horn hung, and blew
> A signal deep and dread, as those
> The storm-fiend at his rising blows,
> And there, upon the mouldering tower,
> Hath hung this sea-horn many an hour,
> Ready to sound o'er land and sea,
> The death-dirge of the brave and free."—*Moore.*

Shells of the same description are common in Lithuania and Muscovy, where they are also applied to pastoral purposes. No sooner is a herdsman risen in the morning, than he winds his horn, and the horses, mules, oxen, asses, goats, and sheep, immediately leave their respective places of retreat, and assemble round their conductor. He then advances at their head, and leads them into such pasturage as he thinks proper for the day. A second signal conducts

them to the waters; and a third commands them home, where each repairs to his shelter for the night. Thus beautifully has Isaiah referred to this ancient custom, which is still common in the East :—"The ox knoweth his owner, the ass his master's crib; but Israel doth not know, my people do not consider."

In Palestine, bee-masters summon their bees by blowing a small whistle, formed of bone or shell. They sometimes collect the humming population of a village, who follow them as orderly as sheep obey the voice of their shepherd, and lead them from one meadow to another, till an impending shower, or the approach of evening, cautions them to return. This singular custom is noticed by St. Cyril, who flourished in the fourth and fifth centuries, as a thing which he had frequently seen. He also mentions that Isaiah refers to it, in the following memorable passage, in which the future conquests of the Assyrian monarch are foretold.*

"And it shall come to pass in that day, the Lord shall hiss (or whistle) for the bee that is in the land of Assyria.

"And they shall come, and shall rest all of them in the desolate valleys, and in the holes of the rock, and upon all thorns, and upon all bushes."—vii. 18, 19.

* Spectacle de la Nature.

A sort of speaking-trumpet, made either of the *Buccinum* or the bark of cherry-tree, is also in much request among the inhabitants of alpine districts. When the last rays of the setting sun appear on the horizon, the shepherd who dwells highest on the mountain blows his horn, and calls aloud, "Praised be the Lord." The neighbouring shepherds then leave their huts, and repeat the words. The sound lasts for several minutes, while every cave and mountain echo repeats the name of God. How solemn is the scene! Imagination can scarcely picture anything more sublime. The profound silence that succeeds, the grandeur of the mountains, the brilliant rays of the setting sun, which illumines their highest peaks, the deep gloom of the valleys below—all conspire to awaken the most solemn reflections. Meanwhile the shepherds bend their knees, and pray in the open air, soon after which they retire to their huts.

"When varying hues of parting day
O'er evening's portals faintly play,
The alpine horn calls, far away,
Praised be the Lord!

"And every hill and rock around,
As though they loved the grateful sound,

Send back, 'mid solitude profound,
Praised be the Lord!

"Just heaven! has man so thankless grown,
He brings no anthems to Thy throne,
When voiceless things have found a tone
To praise the Lord.

"Ah, no! for see the shepherds come,
Though hardly heard the welcome home
From toil of day—they quickly come,
To worship God.

"The cares that made their hearts to bow,
And childhood's laugh, and sunny brow,
All, all by them forgotten now,
In praise to God.

"How lovely such a scene must be,
When prayer and praise ascend to Thee,
In one glad voice of melody,
Eternal Lord!

"All space Thy temple, and the air
A viewless messenger to bear
Creation's universal prayer,
On wings to heaven!

"Oh! that for me some Alpine horn,
Both closing eve and wakening morn

Would sound, and bid my bosom scorn
The world's vain joys.

"Its treasured idols all resign,
That when life's cheating hues decline,
The one undying thought be mine,
To praise the Lord!"

Cassides, or Helmets, are a strong, muscular, but inactive group of mollusks, of which the shells are chiefly distinguished by a solid or inflated growth and short spire, and by the abrupt ascending recurvature of the canal, through which the siphon for conveying water to the breathing-organ passes, and which is of more than ordinary dimensions. The faculties for building in this genus are somewhat vigorously exercised: the mantle which lines the interior of the shell extends in ample folds about the aperture, and secretes that rich display of enamel, which affords so beautiful a material for the engraving of cameos. The *C. tuberosa*, from the West Indies, is chiefly selected for this purpose, on account of its delicate purity of colour. The well-known Bull's-mouth, *C. rufa*, offers a familiar example of the great power exhibited by the genus in the formation of shell, but, on account of its blood-red colour, the enamel is not so well adapted for gem engraving.

The *Cassides* are not very numerous. They chiefly inhabit the Mauritius, Ceylon, the Philippines, and West Indies; two species are found in the Mediterranean, but none on our own coast.

Greek words signifying *Murex* and *Purpura* were used indiscriminately by ancient Greek writers, in reference to all mollusks yielding a purple dye; these became, in consequence, objects of especial interest, on account of the limited sources for obtaining colour.

The purple juice of the mollusk affords, however, no assistance to the lover of systems: it abounds alike in animals of very dissimilar character,—in the *Scalaria* and *Ianthina*, equally with the *Murex* and *Purpura*;—hence the latter term was adopted by Lamarck, to distinguish the genus under consideration, regardless of any property of secreting a purple juice.

Purpuræ differ exceedingly in their details of sculpture, but are somewhat constant in colour. The well-known *P. lapillus*, of Europe, varies in both respects to such an almost inconceivable degree, that no one, who has not thoroughly examined numerous specimens, can correctly estimate its protean character.

Variety is an attribute of creation, and nowhere is it

more fully developed than in the world of shells. The mollusk of the *Dolium perdix*, for instance, is bright blue, contrasted with a dull brown shell; those of the *D. olearium* and *pomum*, of which the one is of a cerulean colour, the other of a rich coppery green, inhabit pale yellowish shells.

The colours of such mollusks as pertain to the genus *Harpa* are, on the contrary, scarcely less vivid than those of the shells which they inhabit. They are often of yellowish-green and rose tint, and curiously ocellated, whilst the breathing-organ is transversely striped.

The shells of this beautiful and very limited genus are too well known to render any description necessary; but among them the Many-ridged Harp, the Rose Harp, and David's Harp are, perhaps, the most distinguished. In each, the prominent longitudinal ribs, which impart the harp-like symmetry of structure to the shell, are regarded as varices, analogous in structure to those of the *Murex*: they form the margin of the aperture, and the intervals between them are probably of rapid growth.

Harpæ mostly inhabit the shores of Ceylon, the Mauritius, and the Philippine Islands; one species, the *H. crenata*, is from Mexico.

The genus *Dolium* constitutes a limited, but very charac-

teristic group, distinguished for their size and muscular strength, and the voracity and comparative activity of their habits. The head is furnished with a long retractile trunk, capable of being rapidly protruded or withdrawn, as also with an ample porous disc, which imbibes water like sponge. When, therefore, the mollusk desires to swim, his will acts upon the disc, which becomes inflated with an enormous quantity of water, and the little mariner is thus enabled to pass over the surface of the deep, wherever his inclinations lead him. M. Deshayes frequently observed this curious process on the shores of the Mediterranean, during his expedition to Algeria.

The shell is, also, admirably adapted for aquatic excursions, being the lightest of spiral univalves; it approaches somewhat in form to that of *Cassis*, but is distinguished by its thinness and want of varices, as also by the absence of any recurvature at the base. A much greater variety and brightness of colour is exhibited in the inhabitant, than in the shell.

The genus *Magilus* presents a remarkable instance of intelligent economy; it affords, also, an example of the fallacy of arranging shells according to their external form and aspect, without reference to the animal inhabitant.

We owe to the researches of Dr. Russell, in Abyssinia, some extremely interesting particulars relative to the habits of this curious mollusk. He ascertained that the creature inhabits masses of Madrepore, and that the worm-like structure of his shell is occasioned by such a confined habitat; that, further, the formation of the shell originates in the same spiral plan as that of similar mollusks, but that, finding it needful to be in immediate communication with the water, the *Magilus* is constrained to alter his spiral mode of growth, in order to keep pace with the enlarging surface of the coral. He pursues, therefore, a straight or flexuous course, and renders the outer portion of his shell extremely solid, in order to resist any pressure from without, and that he may dwell safely within reach of the aperture, by which he maintains a communication with the outer world. The animal himself rarely exceeds two inches in length, although the shell is occasionally prolonged to at least twelve or fifteen inches, by a gradual slipping of the muscle of attachment along the columella, accompanied by a copious secretion of calcareous fluid from the mantle.

This species, like all coral-inhabiting mollusks, is nearly devoid of colouring matter: the shell is of a transparent alabaster white, and the edges of the mantle are tinged

with violet. Peculiar in his habitat and location, this kind of mollusk is apparently restricted to the *Meandrina phrygia* and the shores of the Red Sea.

The growth of the *Magilus* presents a kind of negative analogy with that of the *Nautilus*. The inhabitant of each advances to the outer porch of his cell by the aid of a relaxing muscle, and the mode of their operation is curiously adapted to existing circumstances. The former, in order to sustain the increasing pressure of his coral home, fills up the empty portions of his shell with a solid substance; the latter, having a watery element to contend with, increases the buoyancy of his habitation by several light partitions. If this plan was adopted by the *Magilus*, his outer walls would probably be crushed by the increasing growth of coral; if the *Nautilus* filled up his vacant shell after the manner of the *Magilus*, he would be unable to move from place to place, or to ascend from his haunts in the fathomless abyss.

In both, the instinct of the animal is rendered subservient to the purpose for which it is designed;—the one to glide in its mimic boat, unharmed amid the terrors of the deep; the other to lead a hermit life, imbedded within blocks of coral, for the perfecting of which innumerable workmen are continually employed.

Family IV. Alata.

A list of names; nought else! What use the noting
Of creatures that dwell deep 'neath raging waves?
Speak rather of such curious shells as grace
Our banks, or stream-sides, or beside the main.
Not yet. This wondrous brotherhood of forms
May well detain us, to describe how one,
Like Polypheme, with his lone searching eye,
Progresses on; and how, with two-lobed foot,
Another leaps from tangled weed to stone;
And, strange to say, one lobe supports an eye,
Held up to scan the way, as men at night
Their lanterns hold; whilst others keep at home
And ply their labours with artistic skill.

Wing-like expansions of the outer lip distinguish this interesting family; and first among its six genera stands *Priamus*, with his light, horny, semi-porcellaneous shell. This peculiarity, taken in connection with the absence of epidermis, and a wide-spread stain in contact with the animal inhabitant, leads to the supposition that the creature is of large size, and able to envelope his shell to some considerable extent; that, further, he is probably an inhabitant of deep water, and that if his shell was subjected to micro-

scopic examination, a larger proportion of membranaceous tissue, and less of calcareous matter, than is usually secreted by his brethren, would be discovered.

The second genus, *Struthiolaria*, which inhabits the shores of New Holland, exhibits a strange mollusk, of which the disc is supported on a stout pedicle, with a truncated proboscis-like prolongation of the head, and the absence of a breathing siphon. It seems scarcely possible that such an ungainly and half-formed creature should construct for himself a dwelling, however humble, and dwell therein with facilities for enjoyment. Yet such is doubtless the case, for the power of erecting that same dwelling is productive of happiness to its artificer.

In the animal of the *Aporrhais* a different structure becomes obvious: the disc is truncated in front, carrying at the extremity a small horny operculum; the head is large, the mouth longitudinal, occupying the length of the truncated portion of the head, and the tentacles long and pointed, pedunculated at the base, at the summit of which singular portion is the eye.

Such is the formation of this peculiar mollusk, which yet constructs a dwelling somewhat more elaborate than that of his uncouth brother, having simple or expanded

claws, which are conjectured to serve as anchors in time of need.

The *Rostellaria*, limited in species, and principally affecting China and the Molucca Islands, forms an elegant fusiform shell. The disc is divided into two separate portions, and the animal is thus enabled to change his place of abode by a succession of leaps, instead of the usual method of contraction and dilation.

In like manner, also, the occupant of the *Pterocera* progresses by means of a very restricted kind of leap. For this purpose the disc is curiously two-forked, and in the stouter branch, which is commonly pedunculated, appears an eye of unusually large proportions. This eye is apparently more fully developed than in any others of the Gastropods; it covers the summit of the stout, truncated, and tentacular branch already mentioned, and is composed of a transparent horny material containing an iris, which differs in colour according to the species, and is wonderfully constructed for the transmission of light into an inner chamber.

Equally curious is the faculty possessed by the mantle of expanding into several finger-like divisions when about to suspend its masonic labours, each secreting a massive

claw, which becomes filled with calcareous matter, the hinder one being thrown over the siphon so as nearly to conceal the primitive growth of the shell from the observer; the mantle then withdraws, and, subsiding in wrinkles, deposits that richly-coloured layer of corresponding enamel, with which the columella and the aperture are uniformly adorned at maturity.

The distinguishing peculiarity of the *Pterocera*, or Spider-shell, as regards his testaceous covering, consists in a wing-like expansion of the mature lip. This genus inhabits the seas of the tropics.

Strombi are generally distributed throughout the globe. The largest species, *S. gigas*, is from the West Indies, and several others abound in the same locality; they are also discovered in the seas of China, Ceylon, and the Moluccas, with those of Australia, New Zealand, Peru, California, the Sandwich Islands, and the Red Sea.

Family V. Canalifera.

From morn till dewy eve sat the pale scribe
Within some cloister grey; his ready hand
Tracing on vellum symbols, saintly forms,
Or picturing deeds by honoured ones of old;
And deep within the waters dwelt his co-mate,
Purpurea, such her name, whose wondrous art
Produced that deep cerulean perfect blue,
Which men call Tyrian.

Shell canaliculated, canal sometimes very long, sometimes very short; lip not changing with age.

The family *Canalifera* comprises an extensive range of mollusks, whose shells exhibit great diversity of structure, but are all more or less channelled at the base. This channel is, however, extremely variable: in some of the *Murices* it is of considerable length and tenuity, whilst in most of the *Ranellæ* and *Cancellariæ* it is comparatively obsolete.

"Other characters of equal importance are distinctive of groups. The genera *Fasciolaria*, *Cancellaria*, and *Turbinella* are characterized by a row of oblique plaits on the columella, somewhat after the manner of the *Volutes* and *Mitres*; and the *Tritons*, *Murices*, and *Ranellæ* are distin-

guished by a system of varicose growth, developed with a regularity unknown in any other genus.

"Animals of the different genera belonging to this family, so far as they are at present known, are, with certain modifications, the same throughout. They are distinguished by a short stout disc, truncated head, and fine pointed tentacles, such as are represented in the *Triton tuberosus*. The chief variation consists in the development of the mantle, which in some genera, and even species, is simple, whilst in others it is furnished with that variety of filamentary processes which secrete the fronds, the spires, and tubercles."

The similarity of structure which exists in the mollusks of this family will render any further reference to them unnecessary.

Sixteen genera pertain to the *Canalifera*, among which the following are most conspicuous.

"The genus *Triton* includes a considerable portion of that extensive and admired series of *Canalifera*, whose shells exhibit a peculiarity in their mode of formation, which is conjectured to indicate periods of rest in the calcifying functions of their animal inhabitants." This peculiarity consists in the deposition at intervals of a marginal

ridge, with all its varieties of embellishment, as highly finished and harmonious in its hues, as might be anticipated from a mature artist. Spines and laminæ, or tubercles, are secreted by certain thread-like processes along the edge of the mantle, previous, it is assumed, to a season of rest; or in other words, the animal is able to suspend at will the function of his calcifying organ, thus forming different intervals, in a manner analogous to that which induces the formation of claws in the mature *Pterocera*.

Triton shells are more solid, and yet simple in their structure, than such as pertain to the *Murex* or *Ranella*. They have neither fronds nor spines, nor yet ramified branches like the *Murex*: the rude manner in which their whorls are convoluted seems to indicate that the molluscous occupant, though possessing abundant masonic powers, is of somewhat sluggish disposition. The epidermis is often remarkably thick and hairy, occasionally even varied with bristles in small tufts; and the apex, in numerous instances, is formed apparently of a horny substance, thinly plated with shelly matter. Hence it happens not unfrequently, that the calcareous plating, being broken off, exposes the horny cast beneath. Another peculiarity is obvious in the columella being adorned with a bright coat

of wrinkled enamel, and the outer lip becoming thickened in a manner somewhat curious. This process occurs when the shell is perfected; the lip then curls under, so as to form a deep broad channel, or gutter, which, on being filled up, constitutes a thickened lip. The varices are similarly constructed, each forming for a time the margin of the aperture, and are apparently designed to protect the lip, when the industrious architect ceases awhile from his labours.

The elegant margin of the *T. femorale* is celebrated for having furnished the original model of the gadroon border, used by silversmiths in the decoration of plate.

Shells of the *Triton* were anciently appropriated as trumpets. Their loud and sonorous sounds gave notice, in the early days of Greece, that the common crier was about to perform his office. Both history and tradition teach that the *Triton variegatus* was commonly selected for the purpose. Poets also sang concerning those sea-trumpets, with which the Tritons and attendant nereids announced the setting forth of Neptune, when

> "He mounts the car, the golden scourge applies,
> He sits superior, and the chariot flies:
> His whirling wheels the glassy surface sweep;
> The enormous monsters rolling o'er the deep

Gambol around him on the watery way,
And heavy whales in awkward measures play,
Till parting waves before his coursers fly,
And wondering waters leave his axle dry;
Where in the bay his shining palace stands,
Eternal frame, not raised by mortal hands."

Tritons are widely distributed. Of a hundred species, illustrated in the 'Conchologia Iconica,' the greater number are from the Molucca and Philippine Islands, some few from the western coast of America, some from China, several from New Holland, Ceylon, and Mozambique; one or two are from the Mediterranean, the Cape of Good Hope, the West Indies, and the United States.

Murices include all shells of this family which have more than two varices on a whorl. Of these the numbers displayed by what may be termed the typical species of the genus, is three, imparting a triangular structure to the shell, which has been likened to the calthorp of the ancients, a three-sided instrument of war, that was scattered on the field of battle, in order to impede the progress of horsemen.

Beyond the number of three, the varices are irregular, following one the other in such rapid succession as almost to lose their distinctive character.

Beautiful as regards their architectural embellishments

and the variety of their decorations, none are more worthy of admiration than the shells of this interesting genus. In some, the varices are moulded into elaborate leaf-like fronds; in others are seen a succession of fimbriated laminæ; in others, a row of long tubular spines; in all, variations of ornamental growth, which serve as characters for the subdivisions of the genus. The profuse enamelling of the aperture is also very striking: the colours possess a purity and brightness which no effort of the pencil can imitate. Observe, for instance, the magnificent *M. erythrostoma* from California and the *M. regius* of Panama; the first glowing with the colours of the rainbow, the second uniting the most brilliant colouring and elaborate structure.

History relates that the Romans obtained their celebrated dye from the expressed juice of the *Murex trunculus*, inhabiting the Mediterranean and the shores of Tyre. The *M. brandaris* seems also to have been used for the same purpose; and M. Deshayes attempts to show that remains of this species are still found in consolidated heaps upon the coast, way-marks by which to distinguish ancient stations for the extraction of purple.

This curious fact was ascertained during a scientific expedition to the Morea, when, observing considerable heaps

containing solely the remains of the *Murex brandaris*, Deshayes at first regarded them as evidences of some geological phenomenon. Further consideration, however, led to a different conclusion, and after carefully examining the heaps of shells, in connection with several concurring testimonies, he discovered that these vestiges of old times were uniformly in the vicinity of some ancient ruin, among which were clear indications of their having been used for the manufacture of purple.

Old legends tell that the ancients were indebted for this discovery to the accidental circumstance of a shepherd's dog having stained his mouth when breaking a shell on the sea-shore, and that the colour, having excited the admiration of all who saw it, was applied to the dyeing of silk.

Some historians assign this event to the reign of Phœnix, king of Tyre, who flourished rather more than three hundred years before the Christian era; others, to the time when Minos reigned in Crete, about fourteen centuries previous to the advent of our Lord. But the greater number ascribe the honour of this discovery to the Tyrian Hercules. This renowned hero is said to have presented the first efforts of his ingenuity to the King of Phœnicia, who was so much

delighted with the splendid effect produced by this new colour, that he forbade the use of it to any of his subjects.

Such are the different traditions respecting the origin of the purple dye, which is involved in the same obscurity as pervades the discovery of every art connected with the ordinary wants and necessities of man;—they have generally originated in times beyond the reach of authentic history or tradition, and have been the offspring of his natural faculties, directed by the great primitive wants of food, shelter, and raiment.

But though neither history nor tradition have preserved any authentic information with regard to the origin of this interesting art, yet, from analogy, as well as observation of the practice of barbarous nations at the present day, we can readily credit the fables of the latter with regard to the rude beginnings from which the art has sprung. The rich and gaudy plumage of birds, the finely-spotted skins of animals, coloured shells, stones, and such other substances as nature herself supplies, afford the first materials for savage finery, and indeed suggest the idea of imitating them.

Such was the case in Otaheite, before the light of Christianity arose on that benighted country; and Pomare, in abjuring her idols, renounced also the savage customs of

her ancestors. The caps and mantles of the chiefs were almost wholly composed of feathers, richly coloured, and decorated with the most beautiful shells. Of these a considerable number were the native productions of the country; others derived their lustre from the juices of herbs and flowers.

The high antiquity of the Tyrian purple is confirmed by Homer, who ascribes the wearing of purple ornaments and robes to the heroes of Greece and Rome, and assigns the preparing of them to queens and princesses: in reference to which custom, this great poet and accurate observer thus describes the occupation of treacherous Helen, at the court of Polypus:—

"(Whose sovereign sway
The wealthy tribes of Pharian Thebes obey.)
Alcandra, consort of his high command,
A golden distaff gave to Helen's hand,
And that rich vase, with living sculpture wrought,
Which, heap'd with wool, the beauteous Philo brought;
The silken fleece impurpled for the loom,
Rivall'd the hyacinth in vernal bloom."

ODYSSEY, Book iv. 175.

This beautiful colour was held in such esteem by the ancients, that it was, at one period, especially consecrated to the service of the Deity. Moses used purple stuffs for the

works of the tabernacle, as well as for the habits of the high priest; and among the presents which the Israelites made to Gideon, the Scriptures notice purple habits as some of the spoils of the Kings of Midian.

The Tyrians, by the confession of all antiquity, succeeded best in their purple dye. Their method slightly differed from the one narrated by Pliny, for they merely used such purple shells as abounded on the shores of the Mediterranean, and made a bath of the liquor extracted from the fish. In this they steeped the wool for a certain time, then took it out, and threw it into another boiler, which contained an extract from the *Buccinum,* or Trumpet-fish, only. And hence the wool, which had been submitted to this double process, was so highly estimated, that in the reign of Augustus each pound sold for one thousand Roman denarii, about thirty-six pounds sterling. We need not, indeed, wonder at this enormous price, when the tedious nature of the process is considered, and the small quantity of dye produced by each shell-fish. For fifty pounds of wool, the ancients used no less than two hundred pounds of the liquor of the *Buccinum,* and one hundred pounds of that of the *Purpura,* being six pounds of liquor to one pound of wool: consequently, the real Tyrian purple vied in value

W.Wing, lith.

Reeve & Nichols, imp.

even with gold itself. Ancient writers mention several different shades of purple; one of which appears to have been a kind of dark violet, inclining towards a reddish hue; another, less esteemed, resembled crimson; but the most valued of all was a deep red purple, similar in colour to coagulated blood. A fourth kind, of a whitish cast, has been discovered in modern times.

The wearing of purple robes was, in Italy, originally confined to the first officers of Rome; but, as luxury increased in the capital of the world, they were gradually adopted by the lower ranks of patrician society, till every one who had wealth sufficient to purchase them appeared in the Circus and at the theatre arrayed in these costly habiliments. But the Emperors could not endure that plebeians should thus appropriate a style of dress which had hitherto designated the highest officers of the state. A law was therefore passed, to render it a distinguishing mark of imperial dignity, as well as a symbol of inauguration; and hence, to assume the purple, was a phrase synonymous with that of ascending the throne. At length came one of prouder character than any that had preceded him, and he not only appointed officers to superintend the manufacturing of this imperial dye, but even denounced the punishment of

death against any of his ambitious subjects who dared to usurp the prerogative of the throne. The penalty, so tyrannically inflicted, doubtless occasioned the loss of the art of dyeing purple; first in the west, afterwards in the east, where it flourished till the eleventh century.

The finest kind of purple preserved its brilliancy for a considerable time, and long survived those for whom it was designed. Plutarch relates, in his life of Alexander, that the Greeks found in the treasury of the King of Persia a quantity of purple, which had not lost its beauty, though nearly one hundred and ninety years old.

The ancients also obtained from the coccus, now known by the name of kermes, a colour nearly equal to the Tyrian dye, with which, according to Pliny, it was indeed occasionally blended, under the name of scarlet. The use of the coccus in dyeing is very ancient, since it appears, from commentators, to be alluded to in Exodus:—

"And of the blue, and purple, and scarlet, they made cloths of service, to do service in the holy place, and made the holy garments for Aaron.

"And a girdle of fine twined linen, and blue, and purple, and scarlet, of needle work: as the Lord commanded Moses."—xxxix. 1 and 29.

In after times, the lighter kinds of Tyrian purple were used in dying parchments, or vellum, with the design of rendering still more splendid the gold and silver letters with which they were adorned; and these, Casiri tells us, reflected objects like a mirror. But as Tyrian robes were confined to the palace and person of the Emperor, so this magnificent and expensive style of writing was appropriated to Biblical manuscripts, and the libraries of princes. Theonas admonishes Lucian, the grand chamberlain, not to permit any transcription upon purple vellum, in gold and silver letters, unless especially required by the prince. "I entreat you," says Boniface, Bishop of Mentz, the apostle of Germany, in a letter to the Abbess Cadburga—"I entreat you, send me the epistle of the apostle Saint Peter, written in letters of gold, that by exhibiting them, in preaching, to the eyes of the irreligious, I may procure the greater honour and veneration for the Holy Scriptures." Such was the book of the Gospels, which Louis the Pious gave to the monastery of St. Medard, at Soissons, now in the royal library of France. Such, too, was the Book of Prayers, written in letters of gold upon purple vellum, bound in ivory, and studded with gems, formerly belonging to Charles the Bald, but now in the celebrated Colbertine Library.

The fourth and fifth centuries were equally remarkable for magnificent specimens of chrysography, and of illumination, or ornamental decorations of Biblical manuscripts.

Among the books at the sale of Sir William Burrell's library, in 1798, was a manuscript Bible, beautifully written on vellum, and highly illuminated; it contained the autograph of the writer, Guido de Sars, in which he stated that the work had taken him half a century to execute,—that he had begun it in his fortieth, and finished it in his ninetieth year, during the reign of Philip the Fair, in 1294.

Similar manuscripts were also occasionally made in England. The famous Wilfred ordered a copy of the four Gospels to be written for the church of Ripon, in letters of the purest gold, upon leaves of parchment, purpled in the ground, and variously coloured on the surface. But such were extremely rare, as we learn from the observations of the venerable Bede, who notices the one at Ripon as a kind of prodigy, before unheard of. The Gregorian Bible, presented by a monkish missionary and his companions to the first Christian church erected at Canterbury, was also of a similar description. It was written in red letters, with several splendid purple and rose-coloured leaves inserted in the beginning of each book.

Thus are we indebted to the molluscous inhabitants of the *Murex* and *Buccinum*, for the imperishable dye which distinguished the vestments of the Roman emperors, and for the brilliant decorations of our earliest manuscripts.

The *Murices* which gave rise to this digression are generally distributed throughout the globe. They are represented on the coasts of Britain by the *M. erinaceus*; in the Mediterranean by one or two small species, in addition to several that are figured in the 'Conchologia Iconica'; in California by the magnificent *M. erythrostoma*, and in Panama by the *M. regius*, equally distinguished by its exquisite structure and brilliant colour. The noble *M. ramosus* and *saxatilis* abound in the Eastern Seas, with numerous other species, among which is the well-known Venus's Comb, *M. tenuispina*: a species possessing an extraordinary character and delicacy of structure, that fully compensates for all deficiency of colour.

The genus *Typhis* presents a peculiar characteristic in the development of certain tubes, which are not produced in any other genus.

Shells of this singular group are similar in form and general aspect to those of the *Murex* genus, but invariably small, and distinguished by the peculiarity of a more or less

elongated spouted tube, situated in the middle of the area, between the varices, in place of the usual nodule or tubercle. These tubes bear no resemblance to the spines which are so conspicuously developed in the *Murex tenuissima*, and which, being uniformly open, are modifications of scales or fronds; the tube of the *Typhis* is closed, and is apparently destined for some purpose important to the well-being of the animal. Unique in its construction, no other turbinated genus presents the least analogy.

This genus was founded on a fossil species, the *Murex tetrapterus*, but subsequently found living in the Mediterranean. Since then, four other recent species have been described by Mr. Broderip, of which two were collected by Mr. Cuming at Salango, West Columbia, and the Bay of Caraccas, and one by Captain Sir Edward Belcher, at Cape Blanco, West Africa. Three species were subsequently added by the same enterprising traveller during the voyage of H.M.S. Sulphur, in localities very remote from each other. The first was discovered in from seven to eighteen fathoms water in the Gulf of Nicoya and Bay of Guayaquil; the second was dredged on the L'Agulhas Bank, Cape of Good Hope, at a depth of upwards of fifty fathoms; and the third, the smallest of the series, was found

among gravel and coral, in eighteen fathoms water, at the Straits of Macassar, in the Indian Archipelago.

The *Ficula* is seen progressing in his native element with comparative velocity, owing, most probably, to the lightness of his shell, and his facilities for locomotion. Hence, when captured he is able readily to ascend the sides of a vessel, and the looker-on is not a little amused with his attempts to escape, and the ingenuity with which he puts in requisition all his various resources. Those resources consist of an extensive disc, although unprovided with an operculum, broad and rounded in front and acuminated behind, of a thin mantle expanded into two side-lobes, which cover a considerable portion of the shell, and lastly of a proboscis, which is, however, rarely projected when the creature inclines to move, but, instead of this, long tapering tentacles are stretched out to their full length, and these carry at the base a large black eye.

Thus wondrously constructed, the brotherhood of *Ficulæ* move blithely wherever their inclinations lead them. Some are gorgeously attired, objects, it may be, of no small admiration among such as are less distinguished. The *Ficula lævigata*, a native of the Sooloo Sea, is most gaily decorated: his mantle is bright pink, mottled with white, and lighter

pink; the under surface of his disc is dark chocolate, with yellow scattered spots; his head and neck are also pink, elegantly dotted with yellow spots.

"Rarely has an author the privilege of introducing a genus of seventy-two new species. But such an opportunity have the indefatigable exertions of Mr. Cuming afforded me," as wrote the author of 'Elements of Conchology,' with reference to the genus *Mangelia*. A few only had been previously discovered; one included by Lamarck with the *Cancellaria*, and five mentioned by Mr. Hind in the 'Zoology of the Sulphur.' The latter were discovered by that eminent traveller under various circumstances—some on reefs, others concealed in places under stones, and a few at depths varying from three to twenty-five fathoms. Australia, Sicily, the West Indies, and the Philippine Islands have furnished specimens of the *Mangelia*. The long spindle-shaped *Fusi* are equally delicate and graceful; and this seems to compensate for the absence of bright colours and variety of structure, all being merely more or less tinged with rust-brown, and strongly or faintly keeled and nodulous. One spindle-shaped species, brought from the Straits of Korea, is especially distinguished by the pre-eminent beauty of its structure; each whorl being sur-

mounted by a diadem of erect compressed scales, whence the name of *Fusus pagodus*.

Elongated *Fusi* are principally from the Eastern Seas, China, and New Holland; the ovate species are from a colder climate, and are mostly European.

Fasciolariæ constitute a very natural genus, though limited in species, and are distinguished by their large tubercular growth and brilliant display of colours; there is, also, a character in the style of marking, which obtains some importance from being generally accompanied by numerous transverse lines, in a manner peculiar to the genus, whilst the aperture is in general closely radiated with elevated lines. The columella is further distinguished by one or two plaits, ranging obliquely at the base.

Fasciolariæ are pretty generally distributed, being found in Ceylon and the Philippine Islands, Australia, Western Africa, Panama, Mexico, and West Columbia, Honduras and the West Indies, the Mediterranean, and Cape de Verd Islands. They present, in common with many of their brethren, examples of that assignment of organized beings to different portions of the globe, which is wholly inexplicable, and which is yet subservient to the perfect harmony and order that pervades creation.

Turbinellæ may also be adduced as serving to illustrate the locality of shells. Though affecting warm climates, they are restricted from the Mediterranean, with its olive-shaded shores and sun-lit coves: their principal localities are the Philippine Islands, the Gallapagos, and many a sea-girt isle of the Pacific; they are found, also, in the Mauritius, Zanzibar, Panama, Ceylon, Acapulco, Rio Janeiro, and the West Indies.

The beautiful *T. prismatica* throws out a delicate iridescent lustre on being immersed in water, and many of the genus are exquisitely painted. Among such, and especially conspicuous for his gorgeous apparelling, is the mollusk of *Turbinella cornigera*, a creature clad in deep purple finely marbled with white, the colours being fainter towards the margin of the foot. The eye is said to be distinct and well-formed, having a black pupil, and iris of light yellow. Thus gorgeously bedecked, the creature may be seen progressing with some degree of apparent difficulty, as if oppressed with the weight of his shell. He is, moreover, of a very timid disposition, and shrinks into his dwelling on the slightest alarm. His haunt, therefore, is chiefly among sea-weeds, where he can readily find a cover; and from such a domicile the specimen described by Mr. Reeve, in 'Con-

chologia Iconica,' was procured on the shores of Billiton, an island in the Java Sea, between Borneo and Sumatra.

The interesting brotherhood of *Turbinellæ* present a striking contrast to the rude misshapen object for which the genus *Cyrtulus* was established, although partaking somewhat of the character of *Fusus*, with a certain degree of resemblance to the *Turbinella pyrum* and its congeners, divested of their columellar plaits. This strange shell was discovered by Captain Sir Edward Belcher, at Port Anna Maria, Nukuhiva Marquesa, dredged from a depth of about nine fathoms, and was at first conjectured to be some distorted individual of an unknown species. Subsequent examination, however, caused it be received as a new genus, by Mr. Hinds, assistant-surgeon to the expedition, and as such it is approved by Mr. Reeve. Since then, two or three specimens have been found with the same peculiarity of growth.

The spire of the *Cyrtulus* is characterized by a neat display of sculpture, but suddenly becomes acuminated in the same curiously erect manner as in the *Strombus Thersites*; the last whorl then assumes a rude swollen growth, smooth, though very thick and ponderous, and rising in such a manner around the base of the spire, as to give it a sunken half-

buried appearance, as if the calcifying organ of the animal which had carried on its work with so much beauty and symmetry to a certain point, had suddenly been charged to overflowing, and its architectural design, so to speak, had become nullified.

But though nothing has transpired with regard to the animal inhabitant, the creature has doubtless his peculiar characteristic and his haunt in the deep waters,—sources, too, of enjoyment—nay more, his sphere of usefulness, and forms a link in the great chain of nature.

Many interesting facts have, on the contrary, transpired respecting the genus *Cerithium*, of which the species are very numerous, and inhabit all climates within the mean temperature of the Mediterranean; in a fossil state, they are still more abundant, and afford much research for the geologist.

The *Cerithium nobile*, a magnificent and rare specimen, is selected by Mr. Reeve for illustration in his 'Elements of Conchology.'

The genus is of a somewhat anomalous character, and very dissimilar are the habits of its different members. Some inhabit the sea, others are found in rivers; the former constitute a numerous portion of heavy and solid growth,

exhibiting a certain delicacy of colour and design, and are probably carnivorous; the latter, which inhabit fresh or brackish water at the mouths of estuaries, or live in swamps among the roots of trees, are of a lighter description, and mostly of a uniform dull colour, covered with a horny epidermis. These are oviparous, and may be often found suspended from the branches of trees by means of silken threads, which the creature spins readily after the manner of the silkworm. This peculiarity, first observed in the West Indies by the Rev. Lansdowne Guilding, has also been described by Dr. Trail, in a journal of natural history recently published at Singapore, as also by Mr. Adams, during his visit to Borneo.

Mangrove-swamps, and the mouths of rivers in Singapore and Borneo, are favourite resorts of the *Cerithia*, where they may be seen at one time crawling on the stones and leaves, at another suspended by glutinous threads to the boughs and roots of the mangroves. When about to close his doors during the cold season, the inhabitant carefully contracts himself into his shell, and brings his round horny and semitransparent operculum, or door, to fit closely into the aperture, having previously fixed sixty or seventy glassy, transparent, and glutinous threads about the outer or right

lip, which extend half-way round the operculum, and serve as an anchor, whereby to moor himself securely to his resting-place.

A very handsome species, closely allied to the foregoing, was found by Mr. Adams, crawling languidly on the leaves of the *Pontedera*, as also on sedges in marshy places along the banks of rivers in several parts of Borneo, and many miles in the interior, where the water was perfectly fresh. The eye of this mollusk is terminal, and the proboscis marked with crimson and yellow. The foot is dark brown, and a vivid scarlet line extends round the lower margin.

Family VI. Parasitica.

Look on the Lesser Dodder, whose bright web
Is flung at random, yet with peerless taste,
On shrub or rock, where low the bramble creeps ;
And such the mollusk which doth fix her home
Within the shelly rays of some meek star-fish,—
Strange dweller, yet with wondrous skill to frame
A small thin turbinated shell, from whence
She looketh forth, unvexed by winds or storms.

Animal marine, parasitic, living imbedded in the soft parts of the star-fish, and forming a thin hyaline turbinated

shell: analogous to parasitic plants, which strike their roots into the branches of trees or shrubs.

This elegant little parasite dwells within the fleshy substance of another animal. Mr. Cuming found him closely burrowed in different parts of the rays pertaining to the oral disc of *Asterias solaris*, or Star-fish; and with so much adroitness had the creature made a comfortable dwelling for himself, by the aid, most probably, of his rudimentary foot, that he was almost hidden from sight. With that instinct of self-preservation, imparted to all such parasites which depend for existence upon their nidus, the *Stylifer*, like the *Ichneumon* among insects, carefully avoids the vital parts; hence Mr. Cuming never found his domicile except in the rays, though occasionally penetrating at their base.

The shell of this strange creature is delicate and transparent. When extracted, the older shells present the appearance of a milky clouded glass bubble, but the younger shells are beautifully transparent. And yet even in these a variety of form exists. The *S. astericola* is round as a pea; the *S. subulatus* is long and tuberculated: both forms, however, exhibit the peculiar elevation of the apex, after the manner of a rude mammillary style or column.

Very curious is the structure of the animal inhabitant; somewhat pleasing also, for the mantle of the *Stylifer asterícola* is green, although in form thick, fleshy, and cup-shaped, with a small aperture at the base, and a free back margin enveloping the soft parts, and the last whorl of the shell slightly resembling a small acorn set in its cup. On this mantle is the rudiment of a foot, and from the small aperture is a proboscis, capable of being lengthened, according to the necessities of the inhabitant; and having at its commencement eyes, or rather ocular specks, without pedicles. The branchiæ, or gills, are placed on a single stem, and at the base of the proboscis is a round muscular stomach.

Family VII. Turbinacea.

Wondrous creatures haunt
The world of waters. One doth fitly frame
A top-shaped shell, and then bedecks his home
With patterns such as looms of Indus never
Did body forth; another trencheth round
His door with quaint devices. One doth seek
With vaulted spines to weave a diadem
Whereby to crown his cell, as if he sought
To reign as king; another, zigzag lines
And bands of ample space to deck his shell;

Another, less ambitious, dwells at ease,
In some small cell of plain and simple hue.
But all and each preserve with jealous care
Such forms and emblems as denote their tribe.

Shell tuberculated, either conical or elongately turriculated, sometimes closely, sometimes loosely convoluted; aperture entire at the base, with no indication of any sinus.

Mollusks pertaining to this family are distinguished by their less voracious habits, and the tubularly convoluted structure of their shells. They have rarely any proboscis like their carnivorous brethren, most probably because they chiefly feed on vegetable matter, and their shells are less solid, though rarely fragile.

The genera of this family, amounting to at least twenty, correspond, in a manner, to the Linnæan *Trochus* and *Turbo*, and their shells are mostly lined with an iridescent, pearly nacre. And yet, unlike the *Trochus*, which exhibits the most beautiful varieties of coloured beaded sculpture, the *Phasianella* and *Bankivia* present only a bright array of colour exhibited on a plane surface without the aid of sculpture. The *Delphinula* adorns his shell with a profusion of architectural ornaments; and, in one species, the

tubercles are prolonged into a lofty diadem of vaulted spines. The *Scalaria* produces a unique effect, by a periodical deposit of the reflected margin of the aperture, causing the whorl to become encircled with numerous rings. Lastly, the *Phorus* possesses the remarkable property of attaching to his thin shell, by means of a glutinous exudation, the various pieces of corals, shells, or stones with which he comes in contact. Each species shows a different modification of this peculiarity, which seems in accordance with the fragile nature of the shell.

Turbinacea chiefly inhabit the Eastern world.

Such mollusks as pertain to the first genus, *Turritella*, are apparently a strong and muscular group, the disc being surmounted by a stout pedicle, which upholds the shell and prevents it from trailing upon the ground. A peculiarity is also obvious in the mantle, which is prolonged into a fringed ring, or collar, through which the head passes in and out of the shell.

Although inhabiting alike the East and West Indies, and occurring occasionally on the coast of Senegal and New Holland, *Turritellæ* present none of those brilliant tints which attract the attention of naturalists, and are generally indicative of sunny climes. The shells exhibit little variety

of hue; they are all more or less sombre; but very beautiful is the symmetry of their graduated screw-like proportions.

Shells of the second genus, *Phasianella*, have long excited the admiration of collectors, on account of their highly polished surface and beautifully variegated painting. The fringed collar which embellishes the *Turritella* is also a conspicuous ornament in the occupant of this beautiful shell, and its narrowed disc is distinguished by three pairs of finger-like processes. Even the ear-shaped and calcareous operculum, or small door with which the inhabitant shuts up his dwelling, has its own appropriate ornament.

Home-loving in their habits, the *Phasianellæ* abound in various localities. The larger species are from New Holland; but a small specimen, the *P. pulla*, is conjectured to be found on our own coasts, as also two others in the West Indies and Mediterranean.

Beautiful in his watery haunts, along the shores of New Holland, and well deserving of generic honour, the *Elenchus* has been separated from his brethren; and, though uniform in shape and but little calcareous, the shell is richly iridescent, and the typical character of the genus may be recognized in the well known *Trochus iris*, of which the brilliant rainbow tints are nearly unrivalled.

One solitary species has alone been acknowledged as pertaining to the genus *Bankivia*. The shell has few characters in common with *Elenchus*, being apparently without an epidermis; but its porcellaneous structure resembles that of the *Phasianella*, and it is sometimes banded with deep-red and purple, sometimes tastefully adorned with fine zigzag lines. The columella presents the most important generic feature, being thickly rolled and twisted, and truncated at its junction with the lip, which is thin and not reflected.

The common periwinkle, *Littorina vulgaris*, presents a familiar type of the very natural group to which it pertains, including a multitude of species, of which many are yet undescribed. They dwell on rocks that line the shores, but generally above the water, although within reach of the spray. Their general aspect, and the composition of their shell, indicate that they belong to an animal dissimilar in his habits from *Phasianella*; and such is the fact, for the molluscous inhabitant of the *Littorina* has a more proboscis-like head, but without a fringed collar or finger-like processes.

The mention of the common periwinkle is associated with the cliffs of Tenby, where the shell-collector first saw a

number of these mollusks adhering to the rocks, while the dancing spray bounded towards them as if in sport, and then streamed down the rocks like molten silver.

The morning was one of the finest in July, when a fresh cool breeze gently ripples the surface of the deep; and the distant mountains, beautifully varied with light and shade, are occasionally obscured with floating mists, which sometimes envelope their majestic heads, and again as rapidly disclose them. The scene was beautiful and animating. Light skiffs glanced merrily over the transparent waters, and sea-birds darted from their coverts in the rocks, now rising in the air, now diving into the sea, and again appearing like foam upon the billows. In the distance, stupendous masses of black granite stood forth in all their native majesty, and on the nearest cliffs the glittering windows of a range of houses met the view. Suddenly the mellow tones of the church clock, as if inspired by the spirit of Memnon, began to strike the hour at the moment when the beams of the now risen sun burst in full glory on the surrounding scene, and a long line of radiance streamed upon the face of the waters, occasionally lost or broken by the huge shadows of distant rocks. Meantime the vessel advanced to the shore, and the voyager sprang on land—

> " Seeking whate'er of beautiful or new,
> Sublime or dreadful, in earth, sea, or sky,
> By chance or search was offered to his view,
> To scan with curious or romantic eye."

Few among oceanic artists produce a more delicate and beautifully symmetrical shell, or one more highly prized by amateurs, than the Wentle Trap, belonging to the genus *Scalaria*, and none in which the absence of colour is so lavishly compensated by delicacy and variety of structure.

Strange it seems, that in a genus including nearly a hundred species, affecting, too, in considerable numbers, the seas of equatorial regions, there is little indication of colour. But when this is the case, the molluscous inhabitant seems desirous to make amends for the deficiency of his tribe; the ground-colouring of the whorl is uniformly of a rich semitransparent brown, with rings of the purest white; and very curious is the fact, that the most highly coloured species, the *S. communis* of our own shores, is that which inhabits the coldest region.

The species is chiefly characterized by difference in the number and development of its rings; and these are formed at intervals by the reflected margin of the aperture,

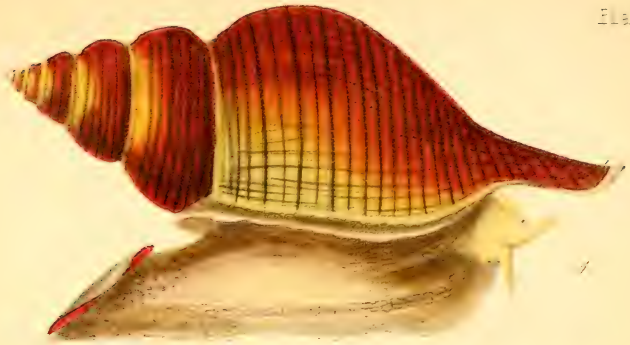
with an especial reference to individuals. Beautiful is the variety which they present, — the more remarkable because the mollusk does not wait till his faculties become developed; he commences the formation of his rings at a very early period. It seems, also, as if each distinct species had its own peculiar pattern, transmitted from one generation to another,—a kind of heraldic crest or emblem distinctive of the tribe. In the well-known *Scalaria pretiosa* of the Chinese Sea, the rings, or varices, are situated at moderate intervals, increasing in area in exact geometrical proportion with the size of the shell; in *S. imperialis* they are developed at more frequent intervals; in the *S. lyra* they resemble silken threads; in *S. raricosta* they are remotely and irregularly deposited; and in *S. alata* they are characterized at the upper part by the addition of a wing-like process. But the most curious development is in the *S. magnifica*, in which the whorls are contiguous, and the typical peculiarities of the genus seem scarcely to enter into its plan of growth, a few slight rings being alone discoverable, at irregular intervals, on the two last whorls.

This genus principally affects the West Indies, Pacific Islands, California, and New Holland.

Naturalists who visit the wild shores of Greenland and Spitzbergen may find the *Margarita*, one of the most conspicuous among their molluscous fauna, in many a wild sea-cove shaded with rocks, that yield the cochlearia and sorrel, those invaluable plants, which uniformly grow together. The species which thus braves the extremity of northern winters, belongs to the first group into which the various species that pertain to the genus *Margarita* are divided, and may readily be recognized by a rather light and spiral structure, largely umbilicated, and resembling the form of *Cyclostoma*.

The second group is distinguished by a more solid growth, having a porcellaneous surface, with the umbilicus filled up by a callous deposit. Unlike the first, which affect a northern latitude, the species inhabits a warm region, its colours are more vivid, and many of the individuals are elegantly striped; the *M. taeniata*, for example, is encircled by fillets of bright red, and the *M. pulchella*, by alternate bands and lines of dark violet-blue.

The animal inhabitants of *Turbo*, *Trochus*, *Delphinula* *Margarita*, and *Monodonta*, are so nearly similar, that questions have arisen with regard to the propriety of separating them. The head of each has a blunt proboscis-like



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form, with the tentacles a little behind, the eyes are upheld on short pedicles at the outer base, and the disc is short and thick, with mostly a calcareous, although occasionally a horny, operculum.

The shells, however, of these genera afford distinctive characters, sufficiently prominent to entitle them to be distinguished in the manner generally adopted; and although the opercula furnish no data for generic arrangement, their varieties are extremely interesting. Those small doors, on which much of the comfort and well-being of the possessors depend, are mostly of a solid testaceous substance, but either smooth or granulous, deeply and circularly grooved with ridges, granulated or serrated, or else composed of club-shaped particles, forming a kind of tuft. An exception with regard to their solid testaceous substance occurs in the *T. pica*, and one or two other species: in these the operculum consists merely of a horny lamina, without any calcareous deposit.

Nor less curious and varied are the shells of the genus *Turbo*; occasionally smooth, and almost porcellaneous, but mostly ribbed or grooved, and ornamented with scales or laminæ. The interior layer and chief substance of the shell consists of mother-of-pearl, often iridescent, sometimes

even of a golden hue. They are, also, remarkable for their symmetry of form and vivid blending of bright colours, and are distinguished by their decided tubular growth, as also by not standing pyramidically on their base, like the *Trochi*.

A complete monograph of the species, by Mr. Reeve, in his comprehensive work the 'Conchologia Iconica,' comprises sixty species, and shows that their range of habitation is limited to warm climates, chiefly the islands of the Eastern Archipelago, Australia, and New Zealand, with the Mediterranean, West Indies, and California.

An exuberance of design in the pyramidical shells of the genus *Trochus*, presents a speciality of character, by which to distinguish it from the *Turbo*. In every species pertaining to that genus, when not absolutely smooth, the sculpture, whether ribs, or scales, or tubercles, is arranged transversely, but in the *Trochus* it is mostly carved longitudinally or obliquely, in patterns more varied and fanciful. *Trochi*, numerous in species, and widely distributed in almost every part of the world, occur on our own coasts, as also in the Mediterranean, and all tropical latitudes.

The solitary *Trochiscus*, a native of New Holland, may be described as a compound of *Turbo*, *Trochus*, *Solarium*,

and *Rotella*. The shell partakes of the heavy substance distinctive of the latter, though smooth on the outer surface, and, as in *Solarium*, the umbilicus penetrates inwardly to the apex; on the other hand, the operculum resembles that of *Delphinula*, with the addition of prominent circular rows of curled flakes;—a compound shell, which seems to comprise the characteristic peculiarities of its brethren, offering another, amid innumerable instances of that inexplicable faculty which produces the most extraordinary results by means apparently inadequate.

The *Rotella* forms another interesting section of the *Trochus* tribe. Small in size, and readily distinguished by its lenticular shape and polished surface, one only, and that of extreme rarity, is otherwise than diminutive, as few exceed half or three-quarters of an inch in diameter. And very curious is the fact, that these polished shells are never found with any extraneous substances attached to them; a singularity which M. Deshayes believes to indicate some peculiar organization, whereby the mantle of the animal is extended over the shell.

Who can look upon the Carrier *Trochus* without admiration? It seems as if the animal occupant was possessed of a powerful cement, which he exudes during the formation

of his shell, and which, retaining its gum-like quality, causes a variety of floating particles to become firmly glued on its surface; nay more, the shell is evidently moulded with reference to this peculiarity. Hence the Carrier *Trochus* is seen loaded with fragments of stones and shells, corals, or such floating substances as are borne at random by the waves. De Montford, therefore, in order to distinguish the *Trochus agglutinans* of Lamarck, a shell long known to amateurs by the name of 'Mineralogist,' and 'Conchologist,' according as its burden was composed either of stones or shells, proposed the name of *Phorus*; and several species are now well known, in which the glutinous property is differently exercised. The shell itself varies materially from the *Trochus* type, being nearly colourless, not pearly, and of a more fragile texture; one or two species present a somewhat *Calyptræa*-like aspect, but such evidently pertain to an animal of locomotive habits, and the whorls are more completely convoluted.

Names indicative of their peculiar burdens are, consequently given to different shells. The *P. onustus* is covered indiscriminately with stones, or shells, or corals; the *P. calculiferus*, of which the gum-like exudation is re-

stricted to the outer edge of the whorls, only collects very small stones, intermixed with valves of the *Nucula* or *Pectunculus*. The *P. corrugatus* attaches flat fragments of shell; the *P. Indicus* and *solaris*, small pebbles on the first or second whorl; and in the *P. exutus* rarely more than traces of pebbles are discernible.

Among these, the *P. onustus* is an inhabitant of the West Indies; all others of the genus are from the eastern world, Japan, China, and the Philippines. The beautiful spouted and tubed *P. solaris*, known to Linnæus, but still extremely rare, is from Malacca.

The elegant Staircase *Trochus* constitutes the type of the genus *Solarium*, to which several interesting species are referred. It presents, as the name implies, a mimic staircase, winding down the interior of the shell; such as Titania, wearied with her journeyings and seeking for a quiet resting-place, might have rejoiced to find,—

> When Night her curtains
> Did throw aside, and forth with dripping locks
> Came her meek sister, Twilight, waking up
> All early birds, and, chief, the soaring lark,
> That bodieth forth his matin song, 'mid clouds
> Of gold and purple.

The architect is little in accordance with the imbodyings of his elegant design. If his dimensions were gigantic, instead of being somewhat diminutive, he would realize one of those strange monsters who are fabled to inhabit enchanted palaces. He stands on a kind of pillar-like supporter, his flat head is prolonged into two horns, and at the base of each are short pedicles, supporting his axis.

Family 8. Plicacea.

> Artists, methinks, are these,
> Of no small worth, and such as duly keep
> The laws of nature, swerving at no time
> From fitly doing what those laws enjoin,
> Teach they of shape or hue, or transverse lines,
> Or beauteous mouldings.

Shell distinguished by having the columella strongly plaited, and the base entire, without indication of any sinus. Animal of marine habits, furnished with a horny operculum.

This family presents a distinct group. Little is known concerning their instincts; and yet, although associated till lately with the *Voluta*, *Bulimus*, and *Auricula*, the shell is found to differ in an important point from the first

genus, by wanting the notch at the base which indicates the passage of an uplifted fold of the mantle used for the conveyance of water to the breathing organs; and from the last by an oceanic location—a fact assumed from the hard porcelain structure of the shell, which seems to indicate that the constructors are of marine habits, denizens neither of fresh water nor of land. They have, moreover, a horny operculum, which serves to protect them in their watery location.

Two genera, the *Pyramidella* and *Tornatella*, both very limited in species, are alone referred to this family.

Assuming that every creature is wonderfully constructed, and adapted to its sphere of being, whether pertaining to the elements of earth, or air, or water, the two preceding genera have, without doubt, an especial reference to their individual localities; the peculiarities of such locations must, however, remain unknown. We know little concerning the bed of ocean, as regards its geographic character, although sufficient has been discovered to prove that it is equally varied with the land;—that huge marine rocks lift their summits to the air and light;—that plains extend in all directions;—and deep sloping valleys, with caves, and giant sea-weeds, exhibit an infinite variety of oceanic vegetation.

Such, consequently, are the haunts of all such species as pertain to the above-mentioned genera. The first has different members, residing either in the Eastern Seas, or in such as lave the shores of New Holland and the Mauritius, where they exhibit pyramidally turreted shells, composed of many whorls, forming an acuminated spire, and having a small semi-rounded aperture, with the plaits of the columella more than usually reverse. The latter present, in their typical form, the reverse of that already described as belonging to the *Pyramidella*. Instead of a small aperture and long drawn-out spire, the shell is of an oval *Bulla* form, with a short spire and oblong aperture, reaching nearly to the summit of the body-whorl. The plait or plaits of the columella range obliquely, and are strongly developed.

Among the few species yet discovered, the rarest and the prettiest, *T. coccinata*, is from the Philippine Islands; others are from Japan, Peru, and the Red Sea.

Family IX. Ianthinea.

Smooth as an inland lake, the deep blue sea;
And blue the heavens, for not a cloud doth flit
Athwart their dome! What mimic fleets are these,
That seem to ride at anchor on the deep?

Animal: head large, prolonged into a short swollen proboscis, having a perpendicular mouth, lips thickened and furnished with prickly hooks or plaits, a pair of unequal tentacles on either side and above the neck, the front one shorter, and having, at the outer base, a very small indistinct eye; foot short, with a broad fin-like appendage, and a float of vesicles. Shell globose, turbiniform, thin and brittle, whorls either rounded or inclined to angular at the periphery, columella long and straight, margin at the aperture thin, never reflected.

Feelings of admiration are associated with the family of *Ianthinea* when recurring to their wonderful construction, and adaptation for a watery element. The beautifully reticulated lung of an air-breathing mollusk is changed into a gill for the respiration of water; the mouth is singularly adapted for the grinding of hard flesh-food of marine origin, which otherwise could not be readily digested; and

to the foot is attached a broad dilated fin, and float, composed of small bladders, for the evident purpose of enabling the animal to move readily in his watery location. And beautiful is the effect produced by tiny fleets of *Ianthinæ*, when calmly riding on the billows of the ocean. Mr. Arthur Adams relates that, in his passage on board the Samarang, from the Cape of Good Hope to St. Helena, several days of calm were experienced, during which the South Atlantic, appearing like a sheet of glass, was covered with innumerable *Ianthinæ*, *Physaliæ*, and *Velellæ*, with companies of flying-fish, and solitary skip-jacks, which suddenly emerged from its depths, and disturbed the stillness by their flights and splashings. He observed that, during the act of swimming, the broad fin-like appendage of the *Ianthina* was fully extended, while the vesicular float preceded the shell, and kept it in a reversed position on the surface of the water. The females had evidently a power of detaching certain portions of the float, with their egg-containing sacks; for, among the vast numbers obtained in the trawls, many specimens occurred with hardly a remnant left, while several isolated floats were taken up. The high seas, therefore, are evidently the home of these beautiful mollusks; and Mr. Adams further relates that he has seen a fleet of many hundreds wrecked on the

coral reefs of the Meia-co-shima Islands, making the shore quite blue at the water line; that, also, he had captured them in masses when adhering to one another by means of the sucker-like fore-part of the foot, in a manner analogous to that of bees; but that, although alive and uninjured, they never made the slightest effort to crawl, which mode of progression seemed to be denied them. They can, however, put forth the end of a long proboscis when either alarmed or injured, which proboscis is armed with numerous curved hooks, and ejects a pretty violet-coloured fluid (which appears to be evanescent as iodine), with the view most probably of bewildering their enemies. The sailing parties, noticed by Mr. Adams, comprised about four distinct species, which seemed in perfect harmony with one another; they became more numerous towards the evening, and entirely disappeared when the breeze sprang up and ruffled the surface of the sea.

The *Ianthina*, thus wonderfully adapted to a watery location, is endowed with the property of emitting a phosphorescent light, and stains the hand with a rich purple colour, which is not easily removed. He is one of the very few among fragile shell-covered mollusks that inhabit the ocean; but, although offering no resistance to the fury of

the waves, he rides upon them in perfect security, wandering into almost every sea, whether tropical or temperate, and deriving from his admirably constructed float a power of rapid motion and wide distribution, with that of active agency in aiding the movements of their aquatic neighbours. Captain King met with a specimen far off at sea, a little north of the equator, during his expedition to the Straits of Magalhaens, so loaded with a species of barnacle and numerous ova, that the upper portion was entirely concealed.

Thus beautifully has a modern poet alluded to the distant range, and often stormy habitat, of this apparently defenceless creature :—

"No gentle rivulet or lake,
Adapted to my slender make,
Where I may softly stem the tide,
And smoothly o'er the surface glide,
Was the safe path allotted me;
But I am cradled on the sea,
Where breakers dash, or lightnings glare,
And hideous monsters grin and stare,
All threatening to devour my bark,
And hurl me to destruction dark.
But He who placed me there, well knew
My weakness, and my danger, too.
And He who rides upon the wave
Is God—omnipotent to save

The meanest, vilest, weakest thing,
That to his faithfulness will cling.
I knew my little fragile form
Could not resist the angry storm;
I owned my weakness—sought for aid,
And every foe a friend was made.
And I was taught to find a home
In the rude billows' raging foam,
Where I could rise at ease, and see
My most entire security.
Oh! I would praise the God of Love,
Who sits the water-floods above."

Family X. Neritacea.

How beautiful, in all their varied forms,
Is this small brotherhood of perfect shells,—
The home of toiling mollusks, who delight
To frame their dwellings as their sires of yore,
And then to paint them with most perfect skill.

Shell abruptly transversely convoluted, and more or less globose, with the spire short, and the last whorl much enlarged.

This family comprises two very distinct groups. The first, including the genera *Navicella*, *Neritina*, and *Nerita*, inhabit seas and rivers: of these, the animal is small, and

the shell remarkable for its beautiful varieties of painting. The second, consisting of the genera *Natica* and *Sigaretus*, is characterized by an animal of larger proportions, generally more or less enveloping the shell, by a thickened ridge, and dilated extension of the foot. The species of this division are uniformly marine.

Such are the two separate groups into which the family *Neritacea* is divided; and these, like nations, have their distinctive characters.

The genus *Naricella* comprises a small genus of fresh-water mollusks, of which the shells are singularly depressed and convoluted, resembling that of the Slipper Limpet, although having little affinity with the Limpet tribe. They inhabit flowing streams, and their symmetrically formed shells are not subject to the distorted irregularities of growth which pertain to such as live attached to the rough surface of marine rocks.

Their shells are generally mottled in lines or subtriangular patches, radiating from the apex, and they are covered with a thin fibrous olive epidermis, the interior being mostly of a bluish tinge. The operculum is composed of two parts, doubtless with a reference to the habits or location of the animal: the one is internal, imbedded between the middle

of the disc and the viscera, and occupying the spiral chambers of the shell; the other is of a stouter substance, and appears to radiate at a right angle with the former.

Navicellæ are singularly restricted in their geographical distribution. They are unknown to Europe and the western hemisphere, but abound in the streams of the Philippine and Feejee islands; they are found also in New Guinea, New Ireland, New Holland, and in Mauritius and the neighbouring isles, where they serve as food to the poorer natives. The largest species is prettily variegated with yellow upon a dark olive-black ground. The *N. lineata* and *Recluzii* are delicate both in shape and colour; they are compressly oblong, and resemble a fragile boat, of which the septum forms the poop.

Neritinæ, or Fresh-water Nerites, have scarcely any geographical restriction, except in the frigid and cold temperate zones. The genus is represented by a humble but very prettily painted species on our own coast, and is plentiful in the West Indies, as also frequent throughout the continent of North, South, and Central America. Magnificent specimens were collected by Mr. Cuming in the Philippines, among which the *N. labiosa*, a fine stout richly-painted shell, is, perhaps, the largest. *Neritæ* are

also more or less plentiful in Sumatra and other islands of the Oriental Archipelago, in India and in South America.

Shells of the *Neritinæ* are more stoutly convoluted than those of the *Navicellæ*, and, as regards the animal inhabitants, there is little difference beyond that which results from different locations. The former dwell principally on river-banks, and are found not unfrequently on palms and water-loving plants.

Few species present any variation of sculpture beyond a slightly plicated or granulated surface, with the exception of such as are coronated with a row of hollow-spouted spines, either short or long. Some are even curiously winged on each side, as the *N. dilatata* and *latissima*.

Sea Nerites construct shells of solid growth, and adorn them with extremely vivid colours, which are yet so variable that the closest observation is required to understand their specific relationship. They are also characterized by variations of sculpture which do not pertain to the fresh-water genus. Many are strongly ribbed, others grained, and, in some species, the *N. ornata*, and well-known Bleeding-tooth, *N. peloronta*, the flat columellar septum is dentated.

With regard to the animal inhabitant of the genus *Nerita*, it differs little from the *Neritina*. The creatures affect

different locations, and hence considerable differences occur in the composition and substance of their shells, according as they inhabit the ocean, or dwell peacefully in estuaries, or places where the water is merely brackish, or else in the vicinity of springs and stagnant marshes, beyond the influence of the tide. Nerites are mostly distributed, like the *Neritinæ*, throughout the globe, though chiefly confined to the equatorial regions. Their name, of poetic and legendary origin, is pleasingly associated with the thought of ocean, and of quiet streams, on the banks of which some of the fresh-water species delight to dwell.

A small shell of the same brotherhood is mentioned by Pennant as common to the coasts of Glamorganshire. Of these a considerable number were recently discovered, together with ivory bodkins, rods, and balls, in the cave of Paviland, fifteen miles west of Swansea, and not far distant from the Worm's Head. This weather-beaten and solitary cave was once most probably the scene of human labours. Fragments of charcoal and the bones of oxen led to this conclusion; and it seemed probable that the small yellow-tinted shells had either been preserved for their beauty, or used in a simple kind of game, which is still common in that part of Glamorganshire. Remains of a

Roman camp are yet visible on the summit of a hill which rises above the cave, a fact that seems to throw some light as regards the date of the bleached skeleton that lay there. Whatever might have been the occupation of the spirit that once inhabited it, the vicinity of a camp would afford a motive for residence in a spot which is now a wind-beaten and uninviting solitude.

Family XI. Peristomata.

> Worthless, perchance, men call them; yet, methinks,
> Sages might gather wisdom, on marsh sides,
> Or where lone waters, dark and sullen, creep,
> 'Mid ferns and sedges; for most strange forms dwell
> Within their precincts, creatures that can breathe
> In air or water, as the seasons change
> From wet to dry.

Shell globose or somewhat turreted, and covered with a dark olivaceous epidermis; aperture generally round, with the margin continuous. Animal fluviatile, furnished with an operculum, either horny or calcareous.

Three genera are referred to this family. The first, *Valvatæ*, are generally found upon aquatic plants, or in ponds and ditches. They may readily be recognized by

small spiral shells, with a discoid or rather elevated spire, by round and convex whorls, a circular aperture, with continuous margin, and a simple and acute lip. The operculum is acute and spiral, and the inhabitant uses it, without doubt, as a door whereby to exclude the cold of winter, during his long sleep.

Concerning the second, *Paludina*, we may briefly state that shells of this genus are very numerous in the great rivers of India and America, particularly near the sea, and in places where the water is a little brackish. Their shells are ovate or conoidal, covered with an olivaceous epidermis; the spire is somewhat turreted, the whorls are round, and either smooth or carinated, and the aperture is also round or ovate, the margin being continuous, and the lip simple and acute. The operculum is horny and orbicular, either waved or spiral.

In the third genus, *Ampullaria*, a peculiarity of structure bears an obvious reference to existing circumstances. The species mostly inhabit shallow stagnant pools, where, in summer, the water is frequently dried up, and, in order to meet the contingencies inseparable from such reverse positions, the animal is provided with two distinct apparatus, the one for breathing in water, the other in air. They are thus

preserved from extinction during the heat of summer; and, when no longer surrounded by their native element, they await without inconvenience the overflowing of their arid dwelling-places.

This peculiarity of character was first made known by Guilding, in his 'Zoology of the Caribbean Islands,' and has since been confirmed by some specimens of *Ampullariæ* brought by M. Cailliaud from Africa.

Family XII. Melaniana.

> Those who go forth to gather shells by streams,
> Or mountain torrents, or still inland lakes,
> Find but scant beauty in their dingy forms;
> Yet each, methinks, doth fitly fill some space,
> And hath its own small sphere of quiet duty.

Shell turriculated; columella sometimes thickened at the upper part; aperture entire or emarginated, margins disjoined. Animal strictly fluviatile, and furnished with a horny operculum. Two genera belong to this family.

The genus *Melania* is found located in lakes, rivers, and rapid streams, which often sweep onward, with their breadth of waters, through deep and primeval forests. Their shells exhibit little of external beauty, and are, for the most part,

of that dark dingy colour which more or less characterizes the shells of all water mollusks; they are, also, generally eroded.

Several varieties have been discovered in the great rivers of America.

Why is it that throughout the domains of nature, with the exception, we believe, of fishes, some instance of perfect black occurs in each? Mollusca are not exempt; the shell of the genus *Melanopsis* is covered with a deep black epidermis, and presents in this respect a singular contrast to the exquisitely tinted coatings of some other species.

In *Melanopsis* the shell is fusiform, or conically cylindrical, covered with a black epidermis; the apex is sharp, the columella smooth, often thickened towards the upper part, and more or less truncated at the lower; aperture generally oblong, acute and somewhat canaliculated above and deeply sinuated below, lip a little reflected, and the operculum horny, spiral, and small.

Such, by river-side or stream, in deep sea-caves, and along the shores of this and other countries, are different members of the Order *Pectinibranchiata*.

FAMILIES OF PULMOBRANCHS.

Family I. Lymnæana.

These wayside creatures dwell
In fens or marshes; hence their simple shells
Are thin and smooth, for little strength they need,
And their dull habitat clothes them in suit of gloom.

The *Lymnæana* constitute a small family of air-breathing mollusks, which live in water. They chiefly inhabit fens, and stagnant pools, and wayside ditches, beside which the marsh-marigold and bright blue mouse-ear often attract the passer-by. Those who stand on the margin of such stagnant or sluggish waters, may observe small bubbles on their surface, occasioned by the sudden emerging of these strange mollusks, in order to breathe freely. And yet they are endowed with the singular faculty of occasionally suspending their respiration for a longer or shorter period, according to need. When, therefore, their homes—the marshes, or wet ditches — become dry during the heat of summer, they are enabled to await, without injury, the return of rainy weather, on which the humidity of their location generally depends.

Four genera pertain to the family *Lymnæana :—Planorbis, Lymnæa, Physa, Ancylus.* No further particulars of interest are recorded concerning this family ; but the mind is naturally directed to that inexplicable faculty, by means of which these apparently insignificant creatures are enabled so to use their breathing-organs, or else by internal mechanism readily to separate from the water so much air as suffices to preserve them when completely overflowed.

The lungs of land animals bear a relation to the air, as a permanently elastic fluid, and by such relationship they live and move; they cannot breathe in water, neither is it necessary—they have an important mission to fulfil on land : with the family of *Lymnæana* the case is different. As yet, nothing is ascertained concerning the purpose which they are designed to effect in the economy of nature ; though, doubtless, there is a purpose ; why else the power of suspending the action of their breathing-organs, by which the breath of life is preserved in them ?

Shells of the *Lymnæana* are rather thin and smooth ; the aperture is generally large, with a simple, acute, but never reflected margin.

Family II. Auriculacea.

Some dwell by ocean wave, in lake, or pool;
Others affect dry stones, 'mid fern and moss;
Others, again, the banks of such great rivers
As Europe owns not.

The shell of the *Auriculacea* is, for the most part, of an oval form, the columella being either dentated or strongly plaited; the aperture is longitudinally oval, and the lip is either thickened or simple, often dentated within, in the same manner as the columella. Animal either terrestrial or aquatic, and destitute of any operculum.

Three genera belong to this family—*Auricula*, *Scarabus*, and *Chilina*—each of which possesses a distinctive character, both as regards its construction and location.

The first is uniformly amphibious, living either on the sea-shore, beside lakes and rivers, or in fens and marshes, among bulrushes and sedges, where the bittern sounds his drum, and the lone shrill cry of the water-rail is heard at eventide. The second differs materially in its habits from the *Auricula*. None of the genera are aquatic, or even peculiar to marshy places: they affect dry stones, and may readily be discovered among the roots of trees in woods.

W. Wing, lith.

Reeve & Nichols, imp.

The third constitutes a group of considerable importance, intermediate between the two families, the *Auriculacea* and the *Lymnæana*, and partaking equally of the characters of both. The members inhabit chiefly the vast rivers of South America, but more especially La Plata;—

> "The sea-like Plata, to whose dread expanse,
> Contiguous depth, and wondrous length of course,
> Our floods are rills."

Different genera of the second family present, therefore, familiar instances of diversified locality and restricted haunts; no one ever trenches on the dwelling-place of another. Such as remain contentedly in stony places, or among the roots of trees, have no wish to roam beyond their precincts: they neither covet the favourite locality of the marsh-marigold and bright blue mouse-ear, nor yet the ample waters of those sea-like rivers which sweep onward in their silent dignity through the plains of the New World.

The shell of this family is much more solid than that of the preceding, and is mostly coated with a stout epidermis, beneath which the animal frequently deposits some variety of colouring.

Family III. Cyclostomacea.

A wider range have these,
Than such as haunt the waters: mountain's side
They climb unbidden; ay, o'er mighty plains
They journey fearless, instinct-taught, to find
The smallest stream that, oozing, maketh damp,
It may be, some small space no eye discerns.

The shell of the *Cyclostomacea* varies exceedingly in form, being either globose or turreted; the aperture is round or semilunar; and the lip, which is generally reflected, is sometimes indented near the columella with a canal or fissure. The operculum, common to all, is either horny or subcalcareous.

This family is divided into four genera:—*Pupina, Truncatella, Cyclostoma,* and *Helicina.*

Conchologists relate that the foot, or organ of locomotion, in the *Truncatella,* is formed, as it were, of two parts, and that he is enabled to move with considerable facility by contracting the space between them into the form of a hoop—hence the cognomen of "looping-snails," which Gray assigned to this genera; that, further, being partially aquatic, the animal can live either under water or on land:

in proof of which, it is related by the Rev. R. T. Lowe, of Madeira, that a specimen was removed from the water, together with several other aquatic mollusks, and put into a dry box, where they remained undisturbed for at least five weeks. On being taken out, and placed in a glass filled with sea-water, the *Truncatellæ* showed signs of life, and soon crawled forth, but the other mollusks were quite dead.

The genus *Helicina* includes many beautiful and new species, in addition to those described by Gray in his 'Zoological Journal.' They were conjectured, in past days, to be decidedly aquatic; but D'Orbigny found several species of this interesting family, journeying through South America, on open plains, as, also, upon the eastern side of the Andes, though generally in damp places, at two thousand metres above the level of the sea. St. Vincent, also, is one of their favourite localities; yet they scarcely, if ever, descend below two thousand feet above the sea, while such as are peculiar to Barbadoes abound in open and dry places.

Cyclostomæ are abundant everywhere, and display considerable variety and symmetry of convolution, as well as the most attractive patterns of colouring.

Family IV. Colimacea.

Doth God take thought for oxen? Lower still
Than oxen, or the conies, feeble folk;
Or the small birds that wing the yielding air,
Or fishes gliding through the azure deep,
Or creatures in green lanes, on mossy banks.
Scorned though they be, His guardian care extends,
His love doth bless! Look on that quiet creature,
At home, and yet abroad. It hath small beauty
With which to please the eye. No use hath it,
That man can tell; and yet no work of art
May rival that poor simple garden-snail,
Progressing on, without or feet or wings,
Imbued with life, and having its own cares,
And quiet pleasure, which man knows not of.

The family of *Colimacea*, or Snails, stands at the head of that portion of Gasteropodous mollusks to which Lamarck gave the name of *Trachelipoda*, or neck-moving. A complete affinity may be traced among them, and hence has arisen many schemes whereby to establish a definite form of classification. The author of 'Conchologia Systematica,' thinking it, however, of little consequence whether the species are arranged in tens, giving to every ten a name, or in hundreds, giving to each a name, so long as a method is

adopted, subservient both to memory and convenience, has divided the *Colimacea* into nine genera, distinguishing the *Auriculacea* and *Cyclostomacea* as separate families. The former differ in being partially aquatic, and in their shells being always strongly plaited at the columella; the latter are terrestrial, their shells are distinguished by the rotundity of the aperture, and in being uniformly operculated.

The geographical distribution of this interesting family is a subject of no small interest in connection with that of mollusks in general. Climate has, doubtless, a decided influence in this respect; but, as a greater uniformity of temperature prevails in the waters of the ocean than on land, the diffusion of marine mollusks is more extensive. As yet, no means have been discovered whereby to ascertain the submarine provinces of shells, as those of terrestrial and even subaqeous plants, although no doubt exists that the boundaries both of latitude and longitude, with regard to oceanic shells, are in general well defined.

The following are nine genera into which the family *Colimacea* are divided:—*Helix, Carocolla, Anastoma, Pupa, Clausilia, Bulimus, Partula, Achatina,* and *Succinea.*

Paley justly observes, that a snail-shell is a wonderful, a mechanical, and, if we may so express ourselves concerning

the works of nature, an original contrivance. "Other animals have their proper retreats, their hybernacula also, or winter quarters, but the snail carries these about with him. He travels with his tent; and this tent, though necessarily both light and thin, is completely impervious either to moisture or to air." The young *Helix*, like his numerous brethren of the univalve order, emerges into life with a covering adapted to his exigencies, which enlarges with his growth by means of a certain viscous exudation from innumerable pores. Now the aptness of this secretion to the purpose for which it is designed, its property of congealing into a firm and hard substance, independent of any effort on the part of the inhabitant, cannot be referred, as the same admirable writer has justly observed, to any other cause than express design; and that not on the part of the unconscious artist, who, although he might build the house, could not supply the materials. Moreover, the form of the building, with its pillar and convolution, is not only a very artificial one, but admirably adapted to the exigencies of the inhabitant; which is confessedly one of the most feeble and unprovided of all artificers. Nay more, the testaceous coverings of such as live on land, or inhabit still ponds and ditches, are scarcely able to resist

the slightest pressure; while in others, their defensive strength suits well with the lives of those that have to sustain the dangers of a stormy element and a rocky bottom, as well as the attacks of voracious fish. The sealing up of the aperture of the shell, which serves in several species as an effectual protection against the cold of winter, is, also, admirably adapted for security as well as warmth. But the epiphragm is not of the same substance as the shell; evidently because the animal would be then unable to break down the enclosing barrier, when the return of spring invites him from his winter quarters. In the midst of an almost endless variety, a striking regularity is nevertheless discoverable. However different individuals may vary in form and colour, according to the sites which they are designed to occupy, in one point they almost universally agree:—the number of whorls in the same species is generally, if not always, the same; and these, with a few exceptions, are uniformly in one direction, that is, from right to left, like the motion of the globe, when the mouth of the shell is turned northward, with the base towards the ground.

The common snail is soft, spongy, and transparent, and is provided with horns, or tentacles, at the extremities of

which the eyes are situated, appearing like small dark spots, sparkling and orbicular. These, on the approach of danger, are rapidly inverted into the head, which immediately disappears beneath the shell. In the course of a few seconds the horns appear, the eyes run up the narrow transparent channel down which they had descended, and the *Helix* journeys on its way.

Now the reason for such a peculiar construction is obvious. The snail is thus enabled to command a more extensive sphere of vision than if the eyes were situated in the head. Moreover, the pliability of the tentacles enables them to turn in different directions, while the case with which they are capable of being extended or contracted, admits the ready withdrawing of the head into the shell; an arrangement which beautifully harmonizes with the extreme weakness of the animal.

Shakespeare notices this striking peculiarity. "I can tell," said the faithful adviser of King Lear, "why a snail has a house." "Why?" replied his unfortunate master. "Why, to put his head in; not to give it away to his daughters, and to leave his horns without a case."

The movements of the common *Helix* are remarkably slow. But how shall we account for this extraordinary

fact, since the snail is light, and small, and apparently by no means incapable of comparatively rapid motion? Doubtless by the viscous nature of his juices, which are extremely tardy in their circulation, and consequently produce a considerable degree of sluggishness in the movements of the animal. This idea was first suggested by Mr. Braidley. He observed their circulation in a snail just hatched, the body and shell of which, being quite transparent, enabled him to discover that the pulsations of the heart succeeded each other at the distance of three seconds.

A casual observer might be inclined to pity the poor creature for the deficiency of his moving powers. But let it not be forgotten that the defect of the *Helix*, in this respect, is amply compensated.—The peculiar nature of his juices seems to have a reference to its mode of life; for no degree of natural or artificial cold has ever been known sufficiently powerful to congeal them. Thus, while the common worm, which incautiously has left his shelter in the garden mould, is frequently discovered in a frozen state, and even birds and small animals fall victims to the severity of the weather, the snail is rendered insensible to cold, and either burrows in the earth, or seeks the shelter of some hollow tree, till invited from his subterraneous dormitory.

Appian beautifully notices the creeping movements of this curious little animal, in the following characteristic lines:—

> "When loved Arcturus leaves the main to rise
> A star bright shining in the evening skies,
> Then prune the vine; 'tis dangerous to delay,
> Till with complaints the swallow breaks the day,
> When with their domes the slow-paced snails retreat
> Beneath some foliage from the burning heat.

And scarcely has the burning heat of summer been succeeded by the chills of autumn, than these slow-paced creatures begin to hibernate, or retire within their domes. This is effected by covering the entrance to their shells with an irregular layer of mucus, which gradually hardens, and forms a calcareous door, that effectually excludes the cold and wet. Thus protected, they remain torpid through the winter; but with the return of spring, and the opening of green leaves, the calcareous covering is either broken by the eagerness of the mollusk to come forth, or else becomes absorbed.

The smallness of his domicile prevents the snail from laying up a supply of food, but this is rendered unnecessary by his extraordinary powers of vitality and abstinence,—in

proof of which it is recorded, on undoubted authority, that instances have occurred of snails, after having been shut up in a torpid state for years, putting forth their heads in full animation, when placed upon a fresh green leaf.

The common snail pertains to a very numerous brotherhood of mollusks, which are more or less distributed throughout the globe. They are destitute of feet, but the want is obviated by such an arrangement of muscles and fibres as renders them capable of a progressive and undulating movement in any direction to which the will of the animal determines.

But why such an extraordinary combination to provide for the security, and promote the comfort, of an obscure mollusk? Let the great truth be solemnly impressed on our minds—God has made nothing in vain. It is a clue that will safely conduct us through many of the intricate mazes of the great labyrinth of nature, as far, at least, as it is permitted for finite beings to explore them. In many instances we are unable to comprehend the intentions of the Deity with regard to the construction of his creatures; in others, their uses are so obvious that they cannot be mistaken. The common chickweed, and the different species which constitute the genus *Helix*, are apparently of

little worth; yet the former, during winter, is nearly the sole support of innumerable flocks of birds, and without the latter a considerable proportion of the animal creation would be entirely destitute of food. In the formation of both, the Creator has deviated from his usual course, to provide for their security, and compensate for all their various and necessary defects.

A considerable number inhabit aquatic plants; others are found on trees or shrubs; and others in decayed wood. They also abound in the most unfavourable and arid situations. The few solitary vegetables which occasionally diversify the extensive sands on the south side of the Tagus, are incrusted with a species of small snail. Such is also stated by African travellers to be the case in the deserts of Sahara.

The *Helix pomatia*, or Edible Snail, differs little in appearance from the common species. His tribe was introduced into England by the celebrated Sir Kenelm Digby, as food or medicine for his lady, when afflicted with consumption; and various attempts have been made to naturalize them in Northamptonshire, but without success, as they uniformly refuse to emigrate from the southern woods of England. They are more susceptible of cold than their brethren, and

close their apertures with a calcareous lid on the approach of winter, during which they remain torpid till the spring.

The same species are used as food during Lent in several parts of Europe, for which purpose they are fattened in large reservoirs strewed with herbs and flowers. Anciently they formed a favourite dish with the luxurious Romans, who fed them on bran and wine till they grew to such a size, that, according to the exaggerated testimony of Varro, each shell would contain a quart. The temperance of the younger Pliny will, therefore, be no longer a subject of admiration, whose suppers consisted of a lettuce for each guest, three snails, two eggs, a barley cake, sweet wine, and snow. Fulvius Herpinus is said to have introduced this luxury, shortly before the wars of Cæsar and Pompey.

Helices furnish even now an important article of food on the shores of the Mediterranean, where they are boiled in their shells, and served up with rice. They possess much of the quality of oysters, being extremely nutritious; hence the use of them not unfrequently retards the fatal termination of that less active form of consumption called a decline; and so long as a sufficient quantity can be obtained, many patients appear convalescent, from the rapid recovery of their strength, owing to this nutritious diet.

Various conjectures have been hazarded respecting the means by which the Israelites were supported during their rapid flight from Egypt, as we are informed in the sacred volume that "the people took their dough before it was leavened, their kneading-troughs being bound up in their clothes upon their shoulders," and that "they were thrust forth out of Egypt, and would not tarry, neither had they prepared for themselves any victuals."

Père Sicard conjectures, with great probability, that the edible snail furnished a considerable portion of their food. This gentleman, in company with M. Fronton, took the very same journey as that pursued by the children of Israel, in their departure from Egypt. It lay through a valley between Mount Diouchi and Mount Torah, and leads to the shore of the Red Sea, opposite Mount Sinai. The following is an extract from his interesting narrative.—

"Although the children of Israel must have consisted of above two millions of souls, with baggage, and innumerable flocks and herds, they were not likely to experience any inconvenience in their march. Several thousand persons might walk abreast with the greatest ease, in the very narrowest part of the valley, in which they first began to file off. It soon afterwards expands to above three

leagues in width. With respect to forage, they would be at no loss: the ground is covered with tamarisk, broom, clover, and saintfoin, of which latter, especially, camels are passionately fond, besides almost every variety of odoriferous plant and herb proper for pasturage.

"The whole of the sides of the valley, through which the children of Israel marched, are still tufted with brushwood, which doubtless afforded food to their beasts, together with many drier sorts for lighting fire, on which the Israelites could, with the greatest ease, bake the dough they brought with them, on small iron plates, which form a constant appendage to the baggage of an oriental traveller. Lastly, the herbage underneath these trees and shrubs is completely covered with snails of a prodigious size, and of the best sort; and, however uninviting such a repast might appear to us, they are here esteemed a great delicacy. They are so plentiful in this valley, that it may be literally said that it is difficult to take one step without treading on them."*

Such are the curious facts which reward the exertions of those who delight to trace the footsteps of unerring wisdom, as they appear impressed on far-off shores, or in the depth

* Schimmelpenninck's 'Biblical Fragments.'

of ocean. But let not him who is confined to inland scenes lament that these researches exceed his fortune or powers of exertion. The mossy lanes which surround his quiet dwelling, or the river that waters his native town, will afford subjects of investigation and improvement. In the shady recesses of the one, or on the margin of the other, he may learn to acknowledge that the wonders of creation are inexhaustible.

For my own part, when I hear of mollusks being able to suspend themselves by means of silken threads from the branches of trees, in order to escape the rapacious grasp of their enemies, or when I watch the common snail slowly ascending the cavernous trunk of some aged tree, or climbing up a garden wall, without the aid of wings, or feet, or thread, solely by the aid of muscular contraction and dilation, and consider the secret spark of life which is in each of them,—that where we look for absolute destitution, and can reckon upon nothing but wants, some admirable contrivance amply compensates for every apparent deprivation, preserving them, and their still more feeble offspring,—my mind is carried up to the praise and adoration of that Gracious Being, whose wisdom, beneficence, and power, are thus conspicuous in the humblest of his works.

In *Anostoma*, the last whorl of the shell is suddenly turned upwards, in a very singular manner, and this is presumed to indicate a considerable change in the habits and economy of the animal inhabitant when arriving at maturity. Until then he must crawl about like others of his relatives, with the spire of the shell uppermost; but, during the formation of the last whorl, he must, doubtless, take a sudden and reversed position, as in the full-grown shell the aperture appears to be on the obverse side to that in the *Helix*, namely, on a plane with the spire, which then becomes undermost.

The *Clausiliæ* derive their name from being furnished with an elastic bony appendage attached to the columella by a slender pedicle, obviously designed to close the aperture. This curious appendage, unlike the operculum, which uniformly adheres to the animal, is a mere addition to the mouth of the shell: it is formed when the animal attains his full growth, and when about to complete the mouth of his shell, and answers, without doubt, some important, though as yet undiscovered purpose, in the animal economy.

Vegetation, heat, and moisture, with distinctive peculiarities of habit, affect not only the shelly coverings, but

also the tints of terrestrial mollusks; hence conchologists easily distinguish such as dwell on the ground from those which climb the trunks of trees and feed among the branches, also such as inhabit regions of drought or excessive dew, from those which are assigned to rainy and woody districts. *Bulimi* present, in this respect, examples of the deepest interest: they are distributed over the equatorial, the tropical, and warm temperate regions of the earth, in specific assemblages, circumscribed as regards their range, and exhibiting in their shells a very distinct typical character.

The molluscous inhabitants of the shells are much less variable, and, being naturally sluggish, with limited powers of locomotion, rarely migrate to any considerable distance, even when not prevented by the natural barriers of seas, or deserts, or mountain ranges. Owing to their frequently dwelling in the branches of trees, Mr. Lovell Reeve considers them to be fitter subjects of investigation, with reference to the laws of geographical distribution, than their relatives the *Helices*, which are more habituated to dwell on the ground, and are less influenced by local circumstances. Some few *Bulimi* are, however, prone to remain on earth,

but when this occurs, very little difference is perceptible among such as inhabit countries that lie far apart.

We owe to an admirable paper, by Mr. Reeve, 'On the Geographical Distribution of the *Bulimi*,' the valuable information that the localities of about five hundred species are known, and that the majority are registered, with their circumstances of habitation. This paper, communicated at a meeting of the Royal Society, speaks also on the modification of their calcifying functions, according to the local physical conditions in which the species occur; and mentions that their area of geographical distribution lies between 40° south and 35° north, in the New World, and 42° south and 60° north, in the Old World—that is, between the southern extremity of Chili and Texas in the former, and between Van Diemen's Land and Sweden in the latter; and, further, that within this wide range, no locality, however dissimilar, exists, in which the *Bulimi* are not found. Little variation occurs with regard to the mollusks themselves, but, as respects distinctions of form, composition, and system of colours, forty typical assemblages of species are distributed over this area, in seven provinces, of which three-fifths belong to the western hemisphere, and the remaining two-fifths, with a wider

range, and more decided local variety of character, in conformity with a greater diversity of soil and climate, inhabit the eastern. The seven typical provinces of distribution are mentioned as Venezuelan, Brazilian, Chilian, Bolivian, Caucasian, Malayan, and African, among which, such local advantages as are most favourable to the calcifying functions of the *Bulimi*, are, abundance of decaying vegetable matter, with an equable temperature of from 80° to 85° in dark, close, humid woods, among shady thickets or in deep ravines, over which

> "Looks out the joyless sun,
> And draws the copious steam from swampy fens,
> Where putrefaction into life ferments,
> And breathes destructive myriads."—*Thomson.*

On sandy plains, and shores of thin calcareous soil, where the vegetation is parched and scanty, or on wide savannahs, *Bulimi* are distinguished by light and often vividly coloured shells; in such, on the contrary, as burrow in the earth, the shell is mostly colourless and often of a grassy texture. Their highest range is in intertropical America, and they extend in both hemispheres, according to the parallels of equal temperature laid down by Hum-

boldt; their calcified condition corresponding also with the northward curves in his isothermal lines along the western coasts of South America, and those bending southward on the eastern side. Consequently such *Bulimi* as inhabit Chili are less vivid in their tints, owing to the vapours precipitated by the great Atlantic current of cold water, which flows nearly to the Gallapagos Islands, than such as are assigned to the opposite Brazilian coast, beside which the equinoctial current rushes with its mighty waters. Recent geological changes which have taken place in the now barren and riverless Patagonia, have suddenly arrested the genus; and with reference to the distant islands of the Pacific, *Bulimi* are curiously represented by other genera of terrestrial mollusks; while species inhabiting islands that approximate towards the neighbouring continents, as Trinidad for instance, partake of characteristics that pertain to those of the main land.

The European species belong to the Caucasian type, which has its centre in Asia Minor. Shells of its numerous genera are mostly colourless, owing to the dry and juiceless character of the thorny vegetation, which affords but scanty nutriment; and the mollusks themselves, having little inducement to roam abroad, mostly remain concealed under

blocks of wood or stone. This type reaches nearly to the south-eastern corner of Asia, where it is suddenly met at Burmah, and in the Malacca peninsula, by the richly-coloured Malayan type, which is so abundantly and beautifully represented in the islands of the Eastern Archipelago; and truly its distribution among these islands is remarkably local.

Bulimi of Northern Africa have much in common with their European brethren; while such as dwell south of the equator belong to a totally different type.

Thus far is the conchologist indebted, for deeply interesting and valuable information, to the researches of Mr. Reeve, whose summary of collected facts will doubtless prove suggestive of future observations, and induce such travellers as take pleasure in natural history to acquaint themselves with the geological and physical history of the earth's surface, and, while noting the precise localities and circumstances of habitation connected with various genera, to aid in determining the laws relating to geographical molluscous distribution.

Family V. Limacinea.

I would counsel thee,
If young in science, to note well the page
Which thus unfolds the structure of strange forms:
Despised it may be, yet most fitly made
For destined purpose.

With the family *Limacinea* terminates the great series of air-breathing mollusks, of which the most part are found buried in damp earth, where they subsist on small worms and various vegetable matter. Their leading characteristics are intermediate between those of the *Aplysiæ* and the *Helices*; resembling the former in the nature and purpose of their shells—namely, that of affording protection to the respiratory cavity,—and the latter as respects their general habits and organization. The breathing apparatus varies considerably in its position:—in some it is situated on the anterior portion of the body, in others at the back, in others, again, it occupies a middle place, whilst the shell, being internal or external, is either simple or spiral.

The *Limacinea* are divided into four genera—*Parmacella, Limax, Testacellus, Vitrina.*

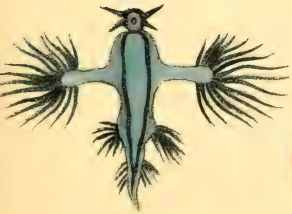
The genus *Parmacella* was instituted by Cuvier, for the

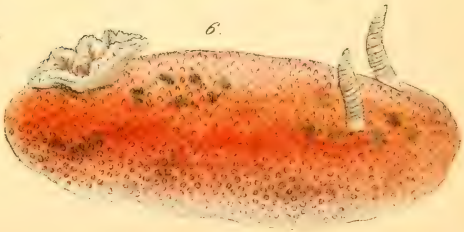
reception of a newly-discovered mollusk, allied to the common slug, but, instead of having a shell inserted near the neck, it is situated about the middle of the back, and is enclosed in a small fleshy scutellum, or shield.

Limaces, or garden-slugs, a genus of mollusks with which most people are familiar, appear to have been mentioned in the earliest records of natural history, but the knowledge of their being occasionally provided with an internal shell is comparatively of modern date. They have few, if any, redeeming qualities in the opinion of gardeners, and yet even these unsightly creatures have a place in the creation, for which they are wonderfully constructed. They possess an internal shell, as already noticed, which is inserted within a fleshy shield upon the back of the neck, and may be described as somewhat irregular, nearly square, smooth, and of a calcareo-crystalline composition, with a thin epidermis.

Another variation, with regard to the position of the breathing cavity, occurs in the genus *Testacellus*. This important organ is placed far back, and consequently the shell, which in this genus is uniformly external, is fixed, as it were, to the tail.

The *Vitrina* somewhat resembles his brother *Testacellus*,





W. Wing & lith.

Reeve & Nichols imp.

but instead of having a simple shell, adhering to that part which is the seat of the breathing cavity, the hinder extremity of the animal is enclosed within a small spiral and fragile shell, covered with a green shining epidermis, into which he can only partially retire.

One, therefore, of these neglected mollusks carries his spoon-shaped shell externally, about the middle of his back; another, within a fleshy shield upon his neck; a third bears it attached to his tail; a fourth presents it as an obvious and shell-like appendage. And yet, although no conchologist would deem either the one or the other worthy of a place in his cabinet, their construction is equally deserving of regard, as those which are elaborately painted and adorned.

The mollusks, also, though plainly coloured, and apparently of little worth, are beautifully tinted; every part of even the common slug is varied with light and dark spots, arranged with inimitable skill.

Look on that feeble creature, and observe how readily he progresses, without feet, a small locomotive engine, and moving occasionally with a considerable degree of swiftness. But how is the want of feet compensated? By the joint action of longitudinal and annular fibres, which are capable

of being shortened or lengthened, drawn up or stretched out; and the result of this action is a progressive movement of the slug in any direction that he wills.

The meanest creature is an aggregate of wonders, a beauteous and elaborate piece of mechanism, which man cannot imitate.

NUCLEOBRANCHS.

Ages have passed since storm-wreck'd mariners
On old Beotia's shores found, 'mid the embers
Left by their beacon fire, a wondrous substance,
Which men call glass, and which in after times
Proved as a gift from heaven, so great its use.
Yet Carinaria, with her glassy shell,
Perchance at that same moment floated by.

Mollusks which pertain to the above order exhibit a peculiarity of organization, on account of their feathered branchiæ being enclosed in a nucleus projecting from the back, and covered with a transparent glassy shell, in a manner distantly analogous to the way in which the branchial cavity is protected in the *Aplysiæ*; and although the general

type of their organization agrees with that of the *Gasteropoda*, it passes through a wide degree of modification.

The ventral disc, for example, which presents a prominent feature in the rest of the class, is here represented by a gelatinous fin, by aid of which the mollusk, being scarcely ever at rest, swims longitudinally on the water with his shell downward.

The solitary genus *Carinaria* was instituted by Lamarck for the purpose of distinguishing a beautifully transparent shell, commonly known as the Glassy Nautilus, which, as already stated, is designed to cover a small nucleus containing the organs of respiration. This transparent shell may be compared, in its appropriation, to those elegant glass shades beneath which exotic ferns are often nurtured.

Carinariæ are very abundant in the Mediterranean and Indian seas; they congregate in considerable numbers, but are rarely visible except at night.

Beautiful *Carinaria*, with thy glassy shell, surely thou art one of the greatest wonders in the deep, though thyself but small. Men think much of that strange substance which opens to the naturalist a miniature world, and assists the astronomer in discovering new stars, which excludes the wind and rain, and enables the inhabitant of northern

climes to cultivate the fruits and flowers of exotic regions. But thou, peerless shell-fish, dost carry upon thy back a globe of glass, to cover the complex organ with which thou breathest, not formed by the art of man nor curious device, but given by thy Creator, and pertaining to thee alone.

FAMILIES OF PLEUROBRANCHS.

> Tokens, in truth, are these,
> Which Ocean handeth forth from out its waters,
> That men may further search, and searching find,
> More wondrous subjects, worthy of deep thought.

This order includes certain mollusks in which the branchiæ, or breathing organs, whether placed under the edge of the mantle, as in the *Cyclobranchiata*, or in a particular cavity, as in most of the *Cervicobranchiata*, are uniformly on the right side. A natural group of mollusks is thus brought together, allied, moreover, by other, and, perhaps, more important affinities;—creatures of strange forms and instincts, inhabiting dissimilar localities, yet everywhere exhibiting the wisdom and beneficence of their Creator.

The *Pleurobranchiata* are not all conchiferous, and of such the generality have merely a thin horny shell, concealed within the mantle, either on the back, or over the breathing cavity.

The order *Pleurobranchiata* is divided into three families:—*Aplysiana*, *Semiphyllidiana*, and *Bullacea*.

Family I. Aplysiana.

Strange mimicry of forms,
Which earth reveals, and causing, in old times,
Men to shrink back with dread from near approach.

In this small family the shells are concealed within the fleshy substance of the mantle; instead, however, of being inserted on the back, they cover the breathing cavity, which is situated on the right side only of the body.

Two genera belong to this family—*Aplysia* and *Dolabella*.

The *Aplysia depilans* of Linnæus, the type of this genus, early attracted the attention of naturalists. His singular resemblance to a crouching hare, increased still further by the ear-shaped structure of the tentacula, gave rise to the appellation of Sea-hare, both among the Greeks and Latins, and by the former, especially, this strange creature was re-

garded with no little superstition. He was believed to exude both a poisonous scent and liquid, and even the sagacious Pliny has recorded suppositious properties which it is unnecessary to repeat. Hence both fishermen and naturalists equally avoided the watery haunts of the Sea-hare, beautiful though they were, and verging on classic shores, where the Nereids were fabled to resort.

The shell of the *Dolabella* is internal and calcareous, generally covered with a horny integument, and in shape somewhat resembling a hatchet: the posterior side is narrow, thicker, slightly spiral, and a little reflected over at the edge; the anterior side is smooth, wider, and entire at the margin.

But why, it may be asked, is this particular description of shell-fish which apparently have neither beauty nor utility? For an obvious reason; namely, that the singularity of their structure may awaken a desire to become acquainted with its appropriation. True it is, that obscure shell-fish, when cast upon our shores and whitening in the sunbeams, are seldom sought for or regarded with any degree of interest. Yet is not this negligence somewhat reprehensible,—a putting away from ourselves sources of refined enjoyment which the Creator of the Universe has

mercifully opened for the solace and instruction of his reasonable creatures?

Family II. Semiphyllidiana.

> There dwell more curious things
> Beneath the waters, than men ever thought,
> Or poet feigned.

In this family the breathing organs are arranged on the right side only; that is, only half-way round the mantle; and hence the name given by Lamarck of *Les Semiphyllidiens*.

Their shell is smooth, sometimes calcareous, sometimes horny, and either external or internal.

The family includes two genera—*Pleurobranchus* and *Umbrella*.

The *Pleurobranchus* exhibits a peculiarity in the breathing organs—their position is right-sided, and their structure plumose. They are occasionally conchiferous, and when this occurs, the shell, being small and merely of a thin horny texture, is concealed within the fleshy substance of the mantle.

The genus *Umbrella* has an external, dorsal, orbicular

and smooth shell, the upper surface rather convex and generally white, the vertex being small and situated near the centre; the under surface is slightly concave, the central disc of a brown yellowish rich colour, with an irregular, continuous, muscular impression running round it.

Little is known with certainty concerning these singular mollusks. One thing, however, is certain—they cannot give utterance to any emotions that may dwell within them. A modern writer has beautifully remarked, that harmony is nature's homage; it may be found in the rolling wave, that foams upon the rugged coast, as well as in the silent murmuring of the rippling stream. In animated nature, the melody of sweet sounds is more palpable to the ear, for in our gardens and about our dwellings the birds never cease to please us with an endless variety of song; but from whatever source such harmony arises, whether from things animate or inanimate, certain it is, that mollusks are silent. This is a curious fact, of which the insect tribes present but few examples. Insects, indeed, are voiceless, in the usual acceptation of the word, but they possess the language of signs, and these they are singularly enabled to render audible.

Family III. Bullacea.

Creatures that dwell at ease in quiet waters,
Where no wild waves lift up their crests of foam,
Nor furious winds lay bare the lone sea-caves
Which Nereids haunt, as fabling poets tell.

This family, with its one solitary genus, *Bulla*, comprises a small group of mollusks, provided with a fragile, lightly-convoluted shell, either partially or altogether concealed within the mantle.

Linnæus included within the genus *Bulla* many species of very dissimilar construction, but Bruguière introduced a complete reformation, retaining it for the reception of those thin, fragile, bubble shells of which the *Bulla fasciata* or *lignaria* may be regarded as the type.

We may consequently assume that the molluscous occupant of the genus *Bulla* is an inhabitant of comparatively still waters, where the waves gently heave, and then subside upon a sandy shore; or else that the creature dwells deep beneath the main. We may see in this adaptation of the simple mollusk to calm waters, a beautiful illustration of the proverb that "God tempers the wind to the shorn lamb." The fragile shell of the solitary *Bulla* is utterly

inadequate to contend with either winds or waves; he is therefore commissioned to abide where neither can work him woe.

FAMILIES OF CERVICOBRANCHS.

Look on the wondrous structure of that organ
Through which the breath of life doth come and go.
How strange its form, and yet how fitly made;—
A living channel, with most curious windings,
A water-course, yet borne upon the neck
Of such as range at will in deepest waters!

The *Cervicobranchiata* are so called because the respiratory organs are situated at the back of the neck, in an oblique line, either upon the surface or in a particular cavity.

A variety of modifications are discovered in the breathing apparatus of such mollusks as pertain to the present order, and their shells are of a very anomalous character. Those of the *Siliquariæ* and *Haliotides*, for instance, differ materially in their growth, notwithstanding the affinity of their animal inhabitants; but an analogy subsists between these two genera, which could not have been anticipated

until the nature and position of the breathing organs became known. The respiration of each requires a continual current of water; and not only is the mantle slit or perforated in that part which covers the cervical cavity, but the shell also, and thus the peculiar formation of the branchiæ has led to the detection of an affinity between two mollusks which had previously been assigned to different parts of the system.

The brief description that pertains to every order seems to us like a door-way opening into a well-ordered museum; and, as the ancients caused appropriate inscriptions to be carved on the doors of public buildings, we desire to present our youthful readers with the following elegant and appropriate lines:—

"Nature never did betray
The heart that loved her; 'tis her privilege,
Through all the years of this our life, to lead
From joy to joy; for she can so inform
The mind that is within us, so impress
With quietness and beauty, and so feed
With lofty thoughts, that neither evil tongues,
Nor greetings where no kindness is, nor all
The busy feverish cares of daily life,
Shall e'er prevail against us, or disturb
Our cheerful faith, that all which we behold
Is full of blessings."—*Hurdis.*

The order is divided into four families—*Tubispiracea, Macrostomata, Capulacea,* and *Fissuracea.*

Family I. Tubispiracea.

What have we here?
Two twisted shells, yet varying, as best suits
Their indwelling mollusks.

Shells of this family may be described as tubular, and irregularly twisted into a loose spire, with a slit occasionally running throughout its entire length. The animal is furnished with a horny operculum.

Two genera belong to this family—*Siliquaria* and *Vermetus.*

The shell of the genus *Siliquaria* is tubular, somewhat cylindrical, and irregularly twisted; the posterior end is more or less attenuated and loosely produced into a spire, which becomes unrolled towards the anterior end, the extremity being open, and the fissure, which is sometimes a little articulated, runs throughout its entire length.

Little dissimilarity prevails between the shell of the *Vermetus* and that of his brother, except that the interior of the shell is often divided by transverse septa. The aperture is round and simple; the operculum horny and concave.

The conchologist longs to become acquainted with the habits and facilities for enjoyment that pertain to the above-mentioned genera; he discovers a difference in their shelly habitations, and is naturally induced to conjecture that this dissimilarity has some important bearing on the economy of the indwelling mollusk. It may be that the one requires to be continually in communication with his native element; that the other dwells alone in his curiously divided chamber, leading a kind of hermit life, and having little communication with the outward world. Be this as it may, it is reasonable to conclude that in both, though probably sightless, the sense of feeling is not wanting; that if the sense of seeing or of hearing is withdrawn, the one of which we speak is peculiarly acute; and that, further, the approach of any extraneous substances is readily discovered by the undulations of the aqueous element which they inhabit.

Family II. Macrostomata.

What spread ye now upon the sounding shore,
In your wild mystic dance, ye circling waves?
Sea-weeds and shells, of varying form and hue;
But chief, the shell of Midas, that choice shell
Than which no others brought by curious hands,
From out the waters, hath more perfect beauty.

Shells of the *Macrostomata* are slightly convoluted, perforated occasionally with a regular series of holes, having a short spire and large aperture; and sometimes the shell is almost entirely enveloped by the mantle.

Four genera belong to this family—*Velutina, Sigaretus, Stomatia,* and *Haliotis.* Each have, doubtless, some peculiar or interesting characteristics, both as regards the molluscous inhabitant and his shell; but as yet, no facts deserving of mention have been obtained, and, therefore, passing over their generic descriptions, we shall speak only of the *Haliotis,* or Sea-ear, as being the most evolved and depressed of spiral shells, and presenting a singularity of structure by which it is readily distinguished. The singularity consists in a row of equidistant perforations on the left side of the shell, made by the animal in his progress

of growth, for conveying water to the breathing organs; and the mantle being partly slit enables the water to pass into the respiratory cavity through a tubular filament protruding from each perforation. These filaments and perforations are the same both in youth and age, except when the hindmost orifice is occasionally filled up.

Internally the Sea-ear is lined with a bright pearly nacre, which is often extremely brilliant, and glows with all the colours of the rainbow. The discrimination of different species depends, however, on external sculpture, and is in nowise effected by the beauteous adornment of the inner surface. Perforations vary, according to the taste, it may be, or necessities of different households, but generally correspond in individuals of the same species; whenever an exception occurs, it uniformly indicates that the shell is inhabited by an adult, because when the mollusk arrives at maturity, he generally closes one or two of the perforations in advance of a fresh opening.

Few, if any, *Haliotides* are found where *Chitons* fix their dwellings, and it seems as if their geographical distribution was exchanged, to a certain extent, in the two hemispheres. A few specimens are found in California, but along the western coast of South America, where *Chitons* are most

abundant, not a single *Haliotis* has ever been discovered, and only one small species, the *H. pulcherrima* (or, the very beautiful *Haliotis*), in the islands of the Pacific. They inhabit the coasts of China and Japan, of Ceylon, Mozambique, and the Cape of Good Hope, with those of Borneo and the Philippine Islands; but the most remarkable are from New Zealand and the continent of New Holland, and these invariably present all that peculiarity of design which characterizes the Fauna of those isolated regions.

The same distinctiveness is discoverable also in the *Haliotis tuberculata* of the Channel Islands. The species, although comparatively abundant at Jersey, is rarely collected on the coasts of England.

Haliotides are found at low water, attached to the under surfaces of masses of stone. Their sense of hearing is apparently very acute, for the slightest alarm causes them to adhere with great force to the rocks, by means of suction.

Many of the shells are extremely beautiful. The magnificent *Haliotis Cunninghamii*, brought from Australia and New Zealand, is finely sculptured on the outside with wrinkled striæ; the colour is of a light rusty red, variegated with flame-like patches of blended green and brown. The fine

dark coral-red *H. rufescens* developes large, oblique, swollen, undulating waves, and in proportion as the back is worn down, the colour becomes of a bright red. And very curious is the fact, that, contrary to the analogy of plants or birds, the beautifully painted *Haliotis Kamtschatkiana*, although inhabiting the cold shores of Oonalaska, in the Northern Archipelago, has more the appearance of a tropical than a northern species, and presents a brighter display of colours than any of the genus. The entire surface consists of wavy swellings, variegated in a somewhat tessellated style, with dark coral-red and bright verdigris, over which the spiral ridges pass here and there, articulated with red and white.

Burke has well remarked concerning the natives of the deep, and his observation equally holds good with regard to numerous mollusca, that although they never quit their native haunts, they speak a language far more emphatic than the thunders of the Vatican. They have each their favourite resorts, either in marine valleys or on open plains, beneath the shelter of sea-rocks, or in their fissures; and while many affix themselves by the aid of ropes, which they form readily, others range at large through extensive forests of sea-plants, than which none

in the vegetable kingdom present a greater variety of specific form.

Family III. Capulacea.

> Look on the tiny anchors, by whose aid
> Some shell-fish moor themselves to slippery rocks,
> Heedless of waves or winds, that madly rage
> Around their homes: they all unmindful,
> Dwelling in silence.

Compensatory contrivances are frequently observable in the lower orders of creation, by means of which local disadvantages are obviated. The present family, which constitutes a natural and well-defined group, presents, in this respect, an interesting and peculiar organization, conferring the power of depositing a testaceous cup or plate on the smooth and slippery sides of marine rocks.

Four genera belong to the *Capulacea,* in each of which a striking peculiarity exists :—*Crepidula, Calyptræa, Hipponyx,* and *Pileopsis.*

The genus *Crepidula* comprises that portion of the *Capulacea* in which the internal appendage assumes the shape of a horizontal septum or shelf (the Slipper Limpets).

The genus *Calyptræa* includes all those in which the septum gradually becomes modified to the form of a detached cup (the Cup-and-saucer Limpet).

A new and remarkable property has been lately discovered by Mr. Cuming, as pertaining to a mollusk of which the shell is closely allied to that commonly known as the *C. equestris*. This distinguished naturalist, having arrived at the island of Zebu, one of the Philippines, found on the coral reefs, which extend to some distance from the shore, numerous dead shells among the deposits of the ocean, in consequence of which he sought for some days to obtain living specimens. Vain, however, were his attempts, till at length, curiosity having induced him to desire the removal of a mass of coral, that lay sunk nearly two feet in the sand, about low-water mark, he caused his attendants to lift it with the aid of levers. After much toil they succeeded in raising the mass sufficiently high to admit of ascertaining that the animal he was in search of lay beneath. The creature adhered to the under surface, and when Mr. Cuming endeavoured to move the shell, he found that it rested on a strong calcareous plate, resembling a flat saucer, and evidently deposited to facilitate its attachment. His anxiety to secure this interesting mollusk in a perfect state, induced

him to direct his men to cleave, if possible, the mass of coral. At least an hour was thus employed, and, after great fatigue, the portion to which the animal adhered was broken off before the tide had risen so high as to render it unsafe to remain upon the reef. Mr. Cuming repeated his search the next day, and having caused several huge blocks to be lifted up, some few specimens were found beneath, but the heavy blows that were required to break off the portions to which they were affixed, either split the accessory plates, or chipped off the edges.

Numerous dead shells were observed lying in like manner upon coral reefs at the island of Bohol, another of the Philippines, as also some living specimens in the same hidden places as at Zebu. The large masses of coral that concealed them, rested immediately on beds of coral sand. No hollow space was discoverable around the shells; they were actually pressed by the immense weight to some depth in the sand, and, from the dark rusty appearance of the time-worn coral, Mr. Cuming concluded that they must have existed in their confined habitat for many years.

In the genus *Hipponyx* the cup can only be considered as an irregular accessory, deposited by the foot in order to

facilitate its adhesion to a rock or stone, and therefore not necessary to its existence. But the *Hipponyces* do not always exercise this property; they are frequently found without the appendage, and when they adhere to other shells, the same object is gained by a peculiar power of absorption.

The shell of the *Hipponyx* is obliquely conoidal, cup-shaped, and generally supported upon a solid testaceous cup; both the shell and cup exhibit two muscular impressions, rounded and connated in the form of a horse-shoe.

Members of the genus *Pileopsis* evidently become fixed without the power of displacing themselves; they resemble the *Hipponyces* in being able to form suitable places of attachment upon other shells, but they cannot deposit a protecting cup or plate.

A pleasant community of quiet creatures is thus enabled to colonize upon the rocks, safely mooring themselves by means thus wonderfully assigned for their well-being, and enjoying, it may be, with grateful hearts, the abundance that is continually impelled within their reach. The tide approaches, with its might of waters and dread sounds, but they fear no ill; the artillery of waves and winds is borne

against them, and breakers scale the rocks, ay, such as might wreck many a proud vessel, yet they heed them not. They know that the winds and waves are messengers of good to them; and the mollusk who looks forth from his dwelling when the waters have subsided, sees around him a plentiful provision for all his wants.

Family IV. Fissuracea.

"Her place each wondrous creature keeps,
Amid unfathomable deeps."

Shells pertaining to this family exhibit the channel by which water is communicated to the branchial cavity, either by an internal siphonal impression, by a marginal sinus, or a complete perforation or fissure, and this in exact accordance with the habits and localities of each.

The five genera are as follows:—*Lottia, Siphonaria, Parmophorus, Emarginula,* and *Fissurella.*

The genus *Lottia* has been till lately associated with the *Patellæ,* as scarcely any difference is perceptible, except in the arrangement of the breathing organs, which, instead of being symmetrically disposed round the body, are situated in a cavity at the back of the neck.

In the genus *Siphonaria* the same organ is within a cavity similarly placed, and the canal or siphon is formed by the passage of water for purposes of respiration.

The *Parmophorus* has a communication between the branchiæ and the water, from the anterior side of the head; the shell is nearly flat, and merely indented at the edge with a kind of sinus.

The breathing organ in this genus *Emarginula* varies between that of the *Parmophori* and *Fissurellæ*; the shell is small, shaped either like a depressed or slightly elevated Cone.

In the genus *Fissurella* the shells are perforated at the summit, for the purpose of conveying water to the respiratory cavity. This perforation, which is generally of an oblong oval shape, was especially noticed by early naturalists; and although the *Fissurellæ*, or Key-hole Limpets, were usually regarded as distinct from the *Patellæ*, or common Limpets, they were not elevated to the rank of a genus. Bruguière was the first to accomplish this desirable separation, and the genus has now become one of considerable interest on account of the new and beautiful species that have been contributed by Mr. Cuming, and which, mostly exhibiting an elegant variety of painting, are highly esteemed by collectors.

Each of these interesting genera might be regarded by a casual observer merely as Limpets, but, when carefully examined, they are found to possess characteristics that exclusively belong to each.

Little is known with certainty as regards their peculiar habits, and the Conchologist, when looking at them, can only regret the impossibility of becoming acquainted with all their instincts and detailed peculiarities. They dwell, it may be, among those groves of gigantic algæ, whose tall yet sessile stems rise to a great height and partly float on the surface of the water by means of innumerable air-vessels, which give them buoyancy; or, perchance, in coral caves, where phosphorescent insects shine like tiny lamps among the fissures, and light the creatures of whom we speak, in their perambulations from place to place. Nor is this the fond imagining of poetic fancy, nor yet the reverie of one who delights in fairy legends; the luminous appearance of the sea has long since been ascertained to result from such minute insects, that one of them would require to be magnified at least four hundred times before attaining the dimensions of a grain of sand.

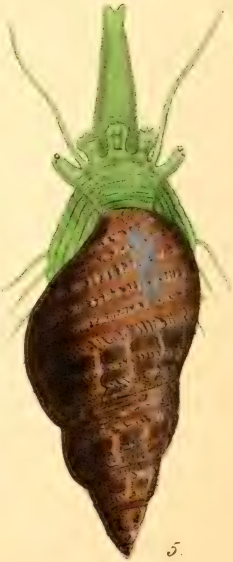
Who shall assign a limit to the wonders of creation! Living lamps diffuse their cheering rays in solitary caverns,

1.

2.

3.

4.



5.

W. Wing, lith.

Reeve & Nichols imp.

or amid the deep dark shade of innumerable sea-plants; they shine in the midst of a humid atmosphere,—nay, even in the midst of water,—and beautifully illuminate those depths into which the rays of the sun can never penetrate. Perhaps, like the enchanted lamp of Armida, they allure many a wandering mollusk,—or, in other words, as insects of every description are powerfully attracted by light, they may compensate to numerous rock-adhering mollusks for the deficiency of their moving powers.

The fire-flies of tropical regions afford sufficient light to guide the traveller on his way, and why should not the fire-flies or glowworms of the deep shed forth their mild pale beams for the benefit of those innumerable living creatures that abound in the depth of ocean?

CYCLOBRANCHS.

> These creatures have a voiceless eloquence,
> Heard 'mid the roar of ocean, though the waves
> Lift up their voices, and the Storm his path
> Makes o'er the mountain billows.

The respiratory organs of the *Cyclobranchiata* may be

described as being somewhat foliaceous or pyramidical in form, and as presenting considerable symmetry; they are more or less continuous, and are placed around the body in a regular series, beneath the edge of the mantle.

Three genera are referred to this order—*Chiton*, *Chitonellus*, and *Patella*.

The great reformer of the Linnæan school, when recording, in the sixth volume of his 'Animaux sans vertèbres,' a list of only six species of the genus *Chiton*, never imagined that nearly ten times that number were dwelling on the western shores of the Pacific, and as many more among the rocks of Australia and New Zealand; that, further, the aggregate of these united would, in the course of twenty years, be nearly doubled by the discovery of species in other localities; yet such are the fruits of recent voyages and discoveries made by naturalists in distant lands.

The first addition to the tropical species of this peculiar genus was made by Mr. Frembly, on the coast of Chili. The indefatigable researches of Mr. Cuming multiplied them to an unprecedented extent, and we are now indebted to the labours of Mr. Lovell Reeve for the exquisite engravings of these and other species in his 'Conchologia Iconica.'

Linnæus assigned the genus to a place among *Lepades*, but Adanson transferred it to the immediate vicinity of the *Patellæ*, and his opinion is confirmed by Cuvier.

The shell of *Chiton*, when compared with that of *Patella*, is not so different as to prevent the expectation of some resemblance in their molluscous inhabitants; it differs, however, very remarkably in being secreted in eight separate pieces, sustained in order by a horny expansion of the mantle, and moving upon each other, after the manner of plate armour, by the aid of three flexible muscles attaching cross-wise to each plate or valve. The horny expansion of the mantle is sometimes only marginal, constituting a frame to the shell, and is characterized by a variety of ornament. Thus, in one the horny ligament appears in its simplest form, thin and transparent; in another, it is covered with a rough arenaceous surface; in another, with thickly-set calcareous bristles. The *C. fascicularis* presents a row of dense tufts of brittle glassy spiculæ; and in the great *C. Sitkensis*, in which the mantle entirely envelopes the shell, the surface is crowded with very close-set minute stars of glassy spiculæ.

The exposed portion of each valve in the shell of *Chiton*, and that which is alone adorned by sculpture or

design of colouring, resembles a convex shield, supported on either side by a raised, triangular, wing-like growth, forming, as it were, the radii of a circular plate, which meet together in the terminal valve. The shells possess considerable beauty when closely examined, and few are more exquisitely framed. The Lineated Chiton, *C. lineatus*, is of an orange-yellow, elegantly striped at the sides, with red white-edged lines obliquely ranged and lightly waved; the shell of the Fulvous Chiton, *C. fulvus*, presents a series of fine opal thread-like lines upon a dark fulvous-brown colour, as if superadded by artificial means in body colour; and among numerous others that might be instanced for their exceeding beauty, the finely-streaked Chiton, *C. striolatus*, is covered with delicate transverse striæ, so exquisitely minute as only to be discovered by the aid of a powerful lens. A stranger in looking at them might imagine that the constructors were active, energetic creatures, with every sense and faculty in full exercise. This, however, is not the case. They pass their sedentary existence in situations almost inaccessible, but which the energy of recent travellers enabled them to penetrate, either by dredging in deep waters, or exploring storm-beaten shores, or searching under isolated masses of rock at about low-water mark.

None among the retired dwellers of the ocean so long eluded the pursuit of the naturalist, but wherever found they amply reward the labour of obtaining them, so curious are they, and singularly varied, so exquisitely adorned, and yet, when casually looked upon, having apparently little of outward beauty to commend them.

Almost every sea, short of the circumpolar temperature, contains different members of this genus, although unequally distributed throughout this extended range. They are most abundant on the south-west shores of America, Australia, and New Zealand; the Eastern Archipelago, Pacific Islands, Cape of Good Hope, the West Indies, Sitka, and the shores of Europe and Asia.

The peculiar structure of the genus *Chiton* readily distinguishes him among the natives of the deep. But why such a different conformation from that which belongs to the testaceous coatings of innumerable others? Because the habits and economy of this curious creature render it needful that he should occasionally roll together into a ball, like the hedgehog or porcupine, on the approach of danger; and by this ingenious expedient he is not only effectually protected from the attacks of his numerous enemies, but

is, perhaps, enabled to elude their vigilance, from the similarity which he bears to a pebble perforated by the waves.

This curious mollusk presents in his construction the appearance of an oblong hirudiniform mass, without eyes, and possessing a thin membranaceous veil in place of tentacula over the mouth, which has a long spiral tongue, furnished with horny denticles. The respiratory organs, selected whereby to characterize the subdivision of the Gastropods, consists of a series of pyramidal leaflets, which encircle the body, as in *Patella*, within a depression between the edge of the mantle and the foot.

Chitons are generally found creeping on the rocks, or closely attached, as the Limpet, to stones or shells, or seaweeds, and not unfrequently to oysters, on the coast of South Devon. But how, it may again be asked, is this effected, for the Creator has denied to them the disc, or byssus, which distinguishes different bivalves?—By means of a gelatinous fluid, which exudes from the under surface of the body. It seems the pleasure of the Deity to produce the same results by an infinite variety of means.

The generic appellation, *Chiton*, is derived from a Greek word, signifying a man's tunic, and aptly expresses the

folded appearance of the valves, which are not unlike the lapping over of a thick warm tunic.

To extract sentiments of piety from the works and appearances of nature, is equally the duty and prerogative of a Christian; it is enforced in the Scriptures, and hallowed by the example of our Lord. "Behold the lilies of the field: they toil not, neither do they spin; yet your Heavenly Father careth for them." He expatiates on the wonderful construction of a single flower, and draws from it the delightful inference of confidence in God. He teaches that taste may be combined with piety, and that the breast which glows with admiration amid the loveliness of nature, may be occupied with all that is serious and important in religion.

But here the observation naturally arises, that though the flowers of the field instruct us—for some of them are beautiful and others admirable in their formation, and poets and moralists refer to them as striking emblems of the mutability of man,—yet, what knowledge or what instruction can we derive from the *Chiton* or *Patella*? I will not further enlarge upon the obvious and important evidences which they afford of benevolence and design. But in considering the very different habitats of these extraor-

dinary mollusks, I have been induced to remember that the same Almighty Being, who enables the *Patella* to remain unmoved in his conically-shaped dwelling amid the fury of contending elements, who permits the feeble *Chiton* to fold himself in a coat of mail resembling a perforated pebble, and thus escape the notice of his marine enemies, has determined the bounds of our different habitations, and assigned to every individual being his respective sphere of action; and that happy will it be for us, if we as steadily perform our portion of allotted duty, as these feeble creatures fulfil the purposes for which they are designed, in accordance with their respective instincts.

Chitonelli may resemble their relatives the *Chitons* in their general organization, but as regards the mantle, and the structure of the shell, they differ materially.

The mantle is thick and fleshy, peculiarly elongated, sometimes covered with a harsh down, but in general tough and leathery, and invariably destitute of any horny cartilaginous part, or spines or bristles, or calcareous armature.

Their valves, unlike those of the *Chitons*, which are firmly set on a strong marginal cartilage, fitting and moving one upon the other, like plate-armour, are of an oblong

form, with the inner projecting plates very much developed, and firmly imbedded within the substance of the mantle; sustained by this alone, they are perfectly isolated from one another, far removed posteriorly, but approximating towards the head, where they are often much crowded by the friction arising from the creature's disposition to thrust himself into holes and crevices.

Chitonelli are peculiar in their habits. They dwell among themselves, and are rarely found in company with their relatives the *Chitons*. The latter abound on the south-west coast of America, where at least fifty or sixty species have been discovered; but not a single *Chitonellus* is found among them. In the Philippine Islands, on the contrary, which *Chitons* seem instinctively to avoid, Mr. Cuming collected the *C. fasciatus*, or banded *Chitonellus*, in considerable numbers and of extraordinary size. Hermit-like, they dwelt in holes or cavities, either of natural formation or else bored by other mollusks, into which they could readily enter, by compressing themselves, even when the dwelling was apparently too small. Holes or circuitous crevices in coral rocks were their favourite resorts in the island of Zebu, and into these they would creep, leaving their hinder portions partially projecting

from the opening in the rock. Specimens obtained by splitting the masses of coral in which they dwelt, often exhibited these curious creatures as having turned completely at right angles, and at angles again, within their narrow abodes.

One exception to the isolated habit of the *Chitonelli* occurred in a small species discovered by Capt. Sir Edward Belcher and Mr. Adams, in the Corean Archipelago, in the Yellow Sea. He was found in company with *Chitons*, and, on lifting the stone that covered his domicile, he travelled away at about the pace of a garden-snail, in search of retirement.

Considerable variety exists, therefore, in the mental characters of different mollusks. One, apparently like the anchorite, loves to dwell alone, another prefers society, a third associates only with his clan. He cannot endure the neighbourhood of creatures formed like himself, with similar necessities and inclinations, if they differ in even a few immaterial points.

Whether the ancient Greeks derived the name of *Lepas*, anciently appropriated to animals of the Limpet kind, from λεπας, a *rock*, as expressive of their being found attached to rocks, or from λεπις, a *scale*, or *rind*, in allusion

to the manner in which marine rocks are frequently covered with their small conic habitations, is a point of little consequence.

The Latins distinguish them by the appropriate title of *Patella*, the name of a small deep dish used for sacrificial purposes; and hence among early naturalists the names of *Patella* and *Lepas* were regarded as synonyms. Linnæus, also, preferred to adopt the genus *Patellus* wherein to include all mollusks having a dish-shaped shell; but as considerable differences in their habits and organization have become known, it has been divided into various genera.

The shell may be described as being elliptic, univalve, not spiral, basin- or dish-shaped, or like a shield or depressed cone, uniformly concave beneath, and having the basal margin often crenated all round: the vertex or summit of the shell is mostly situated near the centre, and always recurved anteriorly, that is, towards the head of the animal. The muscular impression in the interior is elliptic, and interrupted in the same direction.

Limpets are frequently associated with the beauty or magnificence of ocean scenery. At one time their conically-shaped dwellings are seen peeping from among mimic groves or gardens formed of crimson, green, or brown-coloured sea-

weeds, diversified with tufts of corallines, while above them bright emerald waters flash and sparkle, and gently ripple upon the shore; at another they attach themselves to bold masses of huge weather-beaten and wave-washed rocks, which appear as if covered with beautiful grey moss or lichens, but are really encrusted with innumerableLim pets, which cling to them amid the fury of contending billows.

In thus assigning the Limpet to different localities, it seems as if the Creator of the Universe designed not only to embellish their herbless haunts, but that life should be manifested where utter sterility would otherwise prevail. Each of those small cone-shaped dwellings is, therefore, the home of some curiously-constructed being, endowed with faculties for enjoyment, and admirably adapted to its solitary location.

Such were the reflections that arose within us, during a solitary walk on the beach at Weymouth. The sun had just risen, and his broad beams shed a dazzling radiance on the vast expanse of waters,

> "Whose intervening billows' snowy foam,
> Rising successively, seemed steps of light,
> Such as on Bethel's plain the angels clomb,
> When to the slumbering patriarch's ravished sight
> Heaven's glories were revealed in visions of the night."

The scene was indescribably pleasing. The earth, the air, the water, teemed with delighted existence. Myriads of "insect youth were on the wing," trying their pinions in the air, and sporting in endless mazes with inconceivable rapidity. Shoals of little fish darted through the sparkling waves, or bounded from the shallow margin of the water, as if rejoicing in their newly-discovered faculties; while on the nearest rocks a few mollusca, in the shape of sea-anemones, expanded their imitative petals to the sun.

In the foreground a group of dark tempest-beaten stones were covered with Limpets (*Patellæ*), the tapering summits of which, as the waves occasionally dashed them with their spray, presented a beautiful variety of forms and colours. They stood, like Ossian's "lonely dwellers of the rock," solitary in the midst of numbers, and apparently incapable of sharing in the general joy.—But, softly! has not Providence given to every class of beings its peculiar sources of enjoyment? and is not the solitary Limpet exempt from dangers which continually surround the finny natives of the deep? Gradually the beams of the sun illumined the tops of the rocks. One of the shells began to open. A kind of leg, or foot, was carefully projected from beneath the shell, which gently erected itself on one edge as if to

diminish friction, and, by a sudden spring, the creature actually advanced to a considerable distance.

"This," said a fisherman, to whom we pointed out the movements of the Limpet, "is their common method of proceeding. The form of the leg which you observed, may be altered at pleasure: it answers the purpose of a foot, or hand, by the help of which they are able to sink into the mud, rise from it again, and even spring, as you have just observed, from the rocks to which they generally adhere so closely, that it is impossible to remove them without considerable force; unless, for it seems that their sense of hearing is very exquisite, you come upon them unexpectedly."

We boast of our inventions in the arts and sciences, forgetting that we are frequently anticipated by the feeblest of created beings. The Torpedo defended himself from his enemies by means of an electric shock, long before academicians thought of making experiments in electricity. The Limpet acted as if he understood the pressure of the atmosphere, and attached himself to the rock by forming a vacuum in his pyramidal shell, more than five thousand years before the air-pump was invented.

"In Nature's all-instructive book,
Where can the eye of reason look,
And not some gainful lesson find,
To guide and satisfy the mind?
The simple shell on yonder rock
May seem, perchance, this book to mock;
Approach it, then, and learn its ways,
And learn the lesson it conveys.
At distance viewed, it seems to lie
On its rough bed so carelessly,
That 'twould an infant hand obey,
Stretched forth to seize it in its play.
But let that infant's hand draw near,
It shrinks with quick instinctive fear,
And clings as close, as though the stone
It rests upon, and it, were one;
And should the strongest arm endeavour
The Limpet from its rock to sever,
'Tis seen its loved support to clasp,
With such tenacity of grasp,
We wonder that such strength should dwell
In such a small and simple shell.
And is not this a lesson, worth
The study of the sons of earth?
Who need a rock so much as we?
Ah! who to such a rock can flee?
A Rock, to strengthen, comfort, aid,
To guard, to shelter, and to shade;
A Rock, where fruits celestial grow,
And whence refreshing waters flow.

No rock is like this Rock of ours.
Oh! then, if you have learned your powers
By a just rule to estimate;
If justly you can calculate
How great your need, your strength how frail,
How prone your best resolves to fail;
When humble caution bids you fear
A moment of temptation near,
Let wakeful memory recur
To this your simple monitor,
And wisely shun the trial's shock,
By clinging closer to your Rock."—*Wordsworth.*

Little is known with certainty respecting the peculiar habits of the *Patellæ*, or the purposes for which they are designed. They are placed on the boundary line between such shells as are furnished with a regular spire, and those which have none; and they afford, in common with innumerable mollusks, impressive instances that the Most High, who has adorned this beauteous world with a variety of singularly organized beings, has so admirably adjusted them, that every part of the vast creation constitutes one beautiful and perfect whole. To this splendid superstructure nothing can be added, neither anything taken from it, without producing a chasm in creation, which, however imperceptible to us, would materially affect the general harmony of nature.

In the rock-adhering Limpet, the senses of feeling and taste, and perhaps hearing, are alone developed; another species moves readily from place to place, though sightless, as the *Pinna*; a third apparently possesses every sense, with higher instincts and facilities for enjoyment. Between these an unbroken link of connection undoubtedly exists, and therefore, when the observer arrives at certain gaps in the chain of nature, or rather at certain divisions in the general classification between which it is difficult to establish an affinity, the deficiency can only be ascribed to the absence of forms which have eluded his researches.

Hence it is that the naturalist seeks earnestly, by the aid of certain symbols or characters, to bring the objects by which he is surrounded within the bounds of his mental range: with this view he forms a series of artificial divisions, such as classes, orders, and families, with still smaller subdivisions; and while thus employed, he rejoices in the discovery of new forms, that tend to diminish the gaps which still remain open, in a system which he knows to be all perfect.

Very beautiful are such fillings up, and happy is the conchologist when permitted to add even one to those which have already rewarded the researches of his predecessors in the paths of natural history.

Among such is the *Haliotis*, which Linnæus regarded as affording a transition from the non-spiral to the spiral shell; the *Isocardia*, an elegant species, distinguished by its cordate symmetry, and forming an accurate transition from the *Cardia* to *Cardita*; *Cyprina*, in like manner, which establishes a close affinity between the fluviatile and marine conchacea, and *Psammobia*, that serves to connect the genera *Sanguinolaria* and *Tellina*; lastly, the *Myaria*, which forms a natural link between the *Solenacea* and *Mactracea*, and partakes of the characters of both.

It is therefore evident that different kinds of creatures are most harmoniously arranged, rising, in regular gradations, with such a gentle and easy ascent, that the little transitions are almost imperceptible; that class is linked to class with a just and admirable precision, by means of orders, having affinity with both; one order to another; and genera to genera, by innumerable and beautifully-constructed links; and that creation is thus bound together, as it were, by a glorious chain, that encircles its length and breadth.

"Oh, my God," said the admirable Fenelon, "he who does not see Thee in thy works, has seen nothing. He who does not confess thy hand in this well-ordered world, is a stranger to the best affections of the heart. He exists as

though he existed not, and his life is no more than a dream."

CIRROBRANCHS.

Another class of beings, such as men
In olden times knew not, for none had sought,
With curious ken, to trace each small design;—
Though small, yet perfect, and befitting well
Some destined purpose.

The breathing organs pertaining to this order are cirrhous, symmetrically divided into two equal tufts of soft, flexible, club-shaped filaments, attached to a pedicle on the neck. Their structure is very peculiar, and is apparently adapted for a twofold purpose;—that of conveying the vital oxygen to the blood, and that of drawing a current of water by the active movements of their filaments.

One genus is alone recognized as pertaining to this order.

The shell of the solitary genus *Dentalium* is described as being tubular, regular, and symmetrical; it is either smooth or fluted, and more or less curved, the concave side

being ventral, the convex dorsal; it is also much attenuated posteriorly, and both ends are open; the anterior aperture, which is the larger, is simple, and generally oblique, and the posterior, which is also simple, is sometimes slit on the dorsal side.

The *Dentalia* were rightly placed by Linnæus with the mollusca; not, however, from a knowledge of their anatomy, but in accordance with his plan of referring to that division all animals dwelling in a tubular testaceous shell. In so doing they were mingled with *Serpulæ*, which produce a shell of indefinite growth, and belong to the *Annelides*, or Earth-worms, and were henceforth removed from them. They are attached to their dwellings by a distinct muscle, and are provided with an elongated sub-cylindrical foot, whereby to make their way in the sand.

The shells of the *Dentalia* have not much colour, excepting two large green species, *D. elephantinum* and *aprinum*, and a beautiful species collected during the voyage of the Samarang, of large size, very richly variegated with rose, olive-green, and white. One or two species are faint yellow or horny amber, but they are mostly white.

Many elegant and appropriate devices have been suggested by natural objects. The fluted shell of the *Den-*

talium is said to have furnished a design for the shafts of Doric columns; a small basket of wicker-work, also, that was left on the tomb of a young Grecian lady, and became entwined with acanthus-leaves, suggested an appropriate ornament for the volute, or scroll, of the Corinthian order.

CHAPTER VII.

Class III. PTEROPODA.

"The sea! the sea! the moonlit sea!
How calm its slumbering tide,"
And, floating o'er the wide expanse,
Small boats in safety glide.

The limited class *Pteropoda* (from two Greek words, signifying *wing* and *foot*) contains a company of small twilight deep-water swimmers, which obtain their powers of locomotion, as their name indicates, by aid of a pair of fins, somewhat resembling wings, and which alone produce a small, brittle, glass-like shell.

Cuvier was the first who treated them with any degree of scientific accuracy; before his time their existence was comparatively unknown, but since then the researches of D'Orbigny and Souleyet have brought to light many curious facts associated with their habits and geography.

The first of these naturalists, who often passed whole nights in contemplating myriads of these punctual mollusks when floating on the sea, invariably observed that they began to appear with the drawing on of twilight, and that different species came to the surface with the utmost regularity at certain hours of the night. He was, in consequence, induced to believe that they inhabited particular zones, as it were, or different depths of ocean, and that they occupied as many different periods of time in making their way to the surface. When the nights were calm, especially in tropical regions, the surface of the ocean was darkened with swarms of these active creatures, but when day broke, not one was to be seen. They vanished with the first gleam of light on the horizon, like those tiny people

> "Whose midnight revels,
> By a forest side or fountain, some belated peasant sees,
> Or dreams he sees, while overhead the moon sits arbitress,
> And nearer to the earth wheels her pale course."

The depth of the Pteropod's descent is said to be governed by the intensity of light upon the surface of the water; they are "spirits of twilight," as Mr. Reeve has poetically expressed it, "whose downward flight is measured by the opacity of their native element."

These mollusks are conjectured to exist in greater or less abundance in all pelagic waters, and, like the *Carinaria*, they generally swim in company. It is unusual to see them during the day, or in stormy weather, as they delight in calm seas and the stillness of the evening twilight.

With regard to their distinctive features of organization, they are intermediate between the *Cephalopoda* and *Gasteropoda*: the foot of the former, being modified into a kind of swimming fin, offers a transition as it were to the locomotive tentacula of the others. Their structure is somewhat gelatinous and soft, and their hinder parts are enclosed within a glassy shell; their heads are rather indistinct, and almost or altogether destitute of eyes, but their mantles are large and thin, and capable of great dilatation and contraction, Their mouths are most curiously constructed, being subterminal, and provided on either side with one or more membranaceous wing-like swimming fins; their breathing organs are pectinated and internal, similar to those of the Gastropods, but in some species so exceedingly minute, as scarcely to be discerned by even a strong magnifying power. They are not all provided with shells, but when these occur, they are either globose or cylindrical, and for the most part partially or altogether enveloped by the mantle; in some

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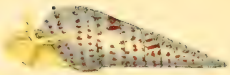

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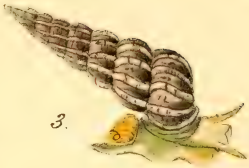

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J. Wing, lith.

Reeve & Nichols, imp.

few instances the shell becomes modified into a kind of gelatinous cartilaginous integument.

Pteropoda are separated into two separate families by De Blainville, namely *Gymnosomata* and *Thecosomata*, naked and conchiferous. As, however, the latter only pertains to the science of shells, they are now divided at once into six genera, as follows:—*Hyalæa, Cleodora, Spiratella, Creseis, Cuvieria, Cymbulia.*

The habits of these singular mollusks have been already noticed; and as regards that interesting species the *Hyalæa*, Professor Scouler speaks of having met with it on a mass of floating algæ which he captured when at sea. He often amused himself with observing the agility with which the active little being climbed up the branches by means of a grooved foot, and that frequently with his back undermost, resembling in this respect the sloth, which inhabits the vast forests of South America, and whose natural history has been only of late understood.

As regards the shell of the Pteropods, we may briefly mention, that similarity, and yet diversity, is conspicuous in each. The shell of the *Hyalæa* is globose and reddish-brown on the uppermost part; that of the *Cleodora* is triangular, thinner, and consequently more brittle and trans-

parent. The little glass shell which pertains to the *Limacina* may be described as hyaline, spiral, obliquely discoid, with a membranaceous lamellar keel, having a large and entire aperture, and being slightly inflated on each side. The genus *Cresis* displays a conically-formed shell, of a pale rose-colour; *Cuvieria*, a thin, white, cylindrical, globular or hemispherical one, of which the posterior end is rounded, obtuse, and truncated, the anterior depressed and open, with a transverse and slightly oblique aperture; *Cymbulia*, a larger and more intricately constructed shell, partially changed into a kind of gelatinous crystalline integument of an oblong, slipper-like shape, truncated posteriorly, open anteriorly, with a nearly lateral aperture.

Such are the elegant and singularly varied boats in which these interesting mollusks sail at eventide, on the calm still surface of the deep, when day has faded into twilight, and stars begin to twinkle in the immensity of space. Imagine a fleet of such meek creatures, resting quietly on the scarcely heaving billows, while as yet the setting sun throws a golden gleam athwart them, and each small boat reflects the parting radiance. Think of them, when midnight settles on the deep, alone, unfearing, although immensity is over them and beneath them, and the heavens at

one moment look as if on fire from tropical coruscations, at another, reveal innumerable stars, which are reflected in the water, and gleam like quenchless flames in the depth of the ocean. Still the creatures float on, each in her fairy-formed vessel, delighting, it may be, in the grandeur and the beauty of the lone wide sea and the glorious pomp of midnight.—

> For who, in truth, may guess or tell,
> What thoughts those tiny bosoms swell?

CHAPTER VIII.

Class IV. LAMELLIBRANCHIATA.

Such creatures earth owns not, nor yet the heavens,
Where birds fly swiftly, carolling their songs,
And insects hum, uprising from their haunts
In groves or meadows.

What think you of a class of mollusks, headless, in many instances incapable of motion, and often blind; living buried in the sand or crevices of rocks, and occasionally attaching themselves to marine substances by silken filaments, yet susceptible of happiness, and subserving important purposes in the economy of nature?

Such are the *Lamellibranchiata* (from *lamella*, diminutive of *lamina*, a thin plate, and *branchiæ*, gills), the fourth class into which the subkingdom Mollusca is divided, an extensive tribe whose mantle is formed into two lobes, each of which produces a separate piece of shell, connected by a

horny ligament. Their name aptly expresses the character of the breathing organs, which are in general large, vascular, and crescent-shaped, placed on either side between the body and the mantle. A perfect system of circulation is performed by means of a small heart composed of a single ventricle, and the lobes of the mantle are fringed round the edge with numerous tentacular filaments, very sensitive and irritable to the touch, and which, being in constant activity, draw a current of water for the ready capturing of their prey.

The *Lamellibranchiata* form a shell composed of two valves joined together by a horny ligament, with mostly a rather complicated hinge. They include two orders—*Unimusculosa* and *Bimusculosa*.

In the first, the points of muscular attachment are always more or less discernible on the internal surface of the shell; the animal is often affixed by a byssus, or beard.

The first order is divided into five families, as follows:—*Ostracea, Pectinacea, Aviculacea, Mytilacea,* and *Tridacnacea,*—better known as Oysters, Mussels, Clams, &c.

Family I. Ostracea.

Methinks the spirit of peace doth seem to brood
Among the rocks and on the sounding shore;
While, sweeping onward from the wondrous deep,
The billows come and go, in ceaseless play,
Spreading upon the sands those rich deposits
Of shells, and sea-weeds, corals, corallines,
Borne up, perchance, from many fathoms deep
In the vast world of waters, moving ever
With congregated roar, or solemn rushing
Upon the sea-sand, stilling all vain fancies,
Filling the calm and listening ear of thought
With serious words.

The *Ostracea* are somewhat allied to the *Pectinacea*, but differ in many essential peculiarities; and the passing out of a bony tendon through an orifice in the shell in two of the genera, is a new and peculiar feature.

Shells of the *Ostracea* may be described as being attached, irregular, either foliated or laminar, and rarely auriculated; they are moreover thin, sometimes quite translucent, and one valve is always larger than the other. The ligament is either internal or semi-internal.

Ostracea are divided into four genera—*Ostrea*, *Placuna*, *Placunanomia*, and *Anomia*.

The shell of *Ostrea* is attached, inequivalve, and irregular,

umboes unequal, somewhat divaricating and receding from each other, as the area between them becomes enlarged by the increase of the shell; the valves are fibro-laminar, and sometimes foliated; the lower valve, which is uniformly larger, is concave; and the upper, or smaller valve, is generally flattish. Hinge destitute of teeth, and the ligament is either internal or semi-internal, attached to the umbonal area. The muscular impression is situated near the centre, and the mark of a minute accessory cartilage has been noticed beneath the hinge, analogous to the *Pinnæ*.

Oysters, in old times, were spoken of as occupying in the scale of nature a degree the most remote from perfection: they were described as being destitute of progressive motion, without art or industry, leading a vegetable life, in perpetual imprisonment, though opening their shells daily to admit the element needful for their preservation. But the light of science and natural history, shining even into the dark cells of the peaceful Oysters, has made known many interesting particulars relative to their natural history.

True it is that the mollusks of which we speak are apparently some of the most insignificant of created beings, nay, they appear little more than gelatinous substances; and yet these feeble creatures are conscious of their existence, and

conscious also that something exists exterior to themselves. They choose, reject, and vary their operations with judgment, defend themselves by adequate and complicated means, repair their losses, and occasionally assume new habits. They possess, when young, the faculty of swimming by means of a simple yet admirable development of their powers; but, when arrived at full growth, this faculty or inclination ceases, and while some of their active relatives are darting round them, they remain contentedly in their places of abode, surrounded by a numerous and continually increasing progeny. When, however, they incline to move, they contrive to bolster themselves up on one side, till they stand nearly upright; and then, availing themselves of the flowing or ebbing of the tide, they open their shells and are tossed over by the pressure of the water. In this respect they differ materially from many of their brethren.

The common Oyster is too well known to render description necessary. Britain was celebrated for this species as far back as the time of Juvenal, who, satirizing Montanus, a noted epicure, says of him—

> "He, whether Circe's rock his oysters bore,
> Or Lucrine's lake, or distant Richborough's shore,
> Knew at first taste."

Sergius Orator, according to the testimony of Pennant, was the first inventor of Oyster-beds, as early as the days of Licinius Crassus, the celebrated Roman orator, commended by Cicero; yet not for his own table, but because of the profit which they yielded. His Lucrine Oysters returned him a large income, for, says Pliny, the British Oysters were not then known.

This country still retains her superiority, and most of the coasts produce Oysters naturally; in such places they are obtained by dredging, and become considerable articles of commerce. Even the shells, when calcined, are useful as absorbents, and, in common with others, they prove excellent manure.

Beds are formed artificially; and those near Colchester have long been celebrated; there are also others near the mouth of the Thames, which are held in great repute. These beds are made by removing the spawn, which is found adhering to stone or wood or to old oyster-shells, and by throwing it into salt-water creeks, where the young, when hatched, grow rapidly, and in two or three years attain their full size.

In the neighbourhood of Colchester, however, a different method is adopted. The fishermen go out with their wives

and children carrying baskets, and in these they place great quantities of small Oysters, which they gather among the sand and pebbles, and which rarely exceed the size of sixpence. These are deposited in beds, accessible to the tide, and remain unmolested till full grown; their flavour is said to be improved for being sheltered from rough waves, and a mixture of fresh water is occasionally introduced for the same purpose.

An ancient custom still prevails in the neighbourhood of London with reference to the Oyster season, for the origin of which we have long sought in vain.

If you go out of your house on that memorable day when the cry of Oysters is first heard in the great city, you are presently surrounded by groups of children who run beside you, holding Oyster-shells in their hands, and looking you in the face with a most beseeching expression of countenance. "A halfpenny, ma'am, for the Oyster-grotto, if you please!" they say. If by chance you are in haste, and tell them so, they run much faster than you can walk; if you assure them that you have not any money, they will beg you to search the corners of your bag or pocket, casting all the time such bewitching glances from their clear, mirthful eyes, that hard must the heart be, or ruefully empty the

purse, if the small boon is refused. "'Tis only once in the year!" they all exclaim; and then one, a pretty little girl, holds up her shell, and another, a little curly-headed boy, pushes his before you, till you can no longer say nay to their entreaties.

And then what unique grottoes reward your acquiescence! I have seen four or five in an evening at a little distance from one another, tastefully made of oyster-shells, lighted from within, and adorned with such flowers as some kind-hearted dame may be wheedled to give from her small garden, when, perchance, one or two of her grandchildren are among the petitioners. Many a smile and courtesy acknowledge your kindness during the past day, and not unfrequently a gentle voice reaches your ear, saying, "Will you please, ma'am, to stop to look at the grotto!"

Although the Oyster-shell exhibits little external beauty or variety, and small difference subsists in general between the members of this family, the *O. folium*, or Leaf Oyster, is peculiar in its construction. The shell resembles a withered leaf, which the wind has tossed at random on the shore, and thus the defenceless occupant effectually eludes the vigilance of birds of prey by a wonderful adaptation of external structure to his feeble circumstances.

The Tree Oyster, on the contrary, attaches himself to the roots and branches of mangroves, as a place of refuge and security. Some persons affect to treat this statement as one of uncertain origin, but the solution is by no means difficult. In hot countries a great variety of shrubs and trees grow on river-banks, and even along the shore, especially in such places as are screened from the agitation of the waves. The sheltered recesses of bays and harbours are, therefore, often filled with abundance of lofty mangroves, which grow up from the shallow bottom, and present the beautiful appearance of marine forests. Wherever they appear on the sea-shore, the beach is not only covered with an infinite number of different insects—feeble beings which love the shade,—but also with mollusks, that hasten to shelter themselves from the violence of the waves, amid the scaffolding of thick and intertwining roots, which rise like lattice-work above the surface of the water, or the branches that dip into it. And to these the parasitic Oysters attach themselves in such numbers, that a loaded branch, when cut off, is too heavy for one person to carry. The loaded branch is then washed, and brought to table, where it forms a favourite appendage at the banquets of the rich; for the glowing tints which are so liberally imparted to the birds

and flowers of tropical regions, extend occasionally to the unassuming Oyster. Many of the species are beautifully shaded, and the shells of such as inhabit the Red Sea are frequently varied with the vivid colours of the rainbow.

The next genus, *Placuna*, is easily recognized by the thinness and flatness of the valves, and peculiar construction of the hinge, which consists of two distinct ribs or ridges, on one valve only, diverging upwards; and to the outer edge of these is affixed the ligament.

Specimens of *Placunanomia* were found attached to dead bivalve shells and corals, at the depth of eleven fathoms, in the Gulf of Dulce, province of Costa Rica, Central America, by Mr. Cuming, who had spent many years in diving and dredging for this remarkable genus, which, as the name denotes, is intermediate between the *Placuna* and *Anomia*. Like the former, the hinge consists of two divaricate ribs, bearing the ligament; and, like the latter, there is an opening in the lower valve for the passage of a bony tendon, by which the mollusk attaches himself to his watery location. This tendon, however, is rather a singular modification of that which pertains to the *Anomia*: instead of directly perforating the lower valve, it is first introduced, like a flat plate, between the laminæ of which the valve is composed,

and then passes out for the express purpose of attaching itself, through a narrow longitudinal fissure; it is moreover confined within the aperture,—not free, as in *Anomia*.

Anomiæ live also attached to rocks and marine substances by the aid of a muscular tendon passing through a distinct orifice in the shell. This adhesive tendon secretes a series of thin subcalcareous plates on the surface to which it is affixed; and when these become amalgamated and hardened, they form what has been called the stopper.

Shells of this adhering species assume the shape of whatever substance they come in contact with. If found on a flat surface, they are well and regularly formed; if, on the contrary, upon the radiated valves of a *Pecten*, they are ribbed accordingly; and if confined between the spines of an *Echinus*, they become compressed. This may probably arise from the fact of the *Anomiæ* being without an organ of locomotion: they never move from their places of abode, but live and die, like people of the olden time, wherever their lot is cast.

And yet, though tenaciously adhering to their stationary or floating homes, these contented creatures see not a little of the watery world: they are widely diffused throughout the European, American, and African oceans, as well as in

the Mediterranean and Northern seas. Their shells are generally thin and semitransparent,—peculiarities rarely discoverable in such as inhabit the wide ocean,—and they evince in their construction both an inconvenience and a compensation. But in order to remedy this peculiarity, or to prevent such fragile shells from being injured by the violent tossings of the waves, a small perforation is obvious near the beak, and through this a strong ligament, as already noticed, is protruded, whereby the little sailor securely fixes himself to marine substances, such as fuci and crabs, the spines of *Echini*, and especially to the *Madrepora prolifera*.

The shells are various, and many of them are singularly beautiful. The Snake-head, when seen in profile, resembles an antique lamp, and the *A. psittacea* is very similar to the recurved beak of a parrot, while the Cake *Anomia* is capable of being rendered transparent by the ingenious Chinese, who use it as a substitute for window-glass.

We have spoken elsewhere, and more at large, concerning the prismatic arrangement of the carbonate of lime in shells. The *Anomia ephippium*, when submitted to a high magnifier, presents a beautiful example of this arrangement in a variety of tubes, which seem to commence from the inner surface of the shell, and pass towards the exterior. The membranous

shell-substance which constitutes the internal layer is thus traversed with fairy-formed and extremely minute tubes, constituting an irregular net-work, which spreads out in a plane parallel to the surface, at first scantily distributed in the internal nacreous lamina, but becoming abundant in the yellow outer layer.

We have already observed that the tendon of adhesion secretes through its fibres a series of thin subcalcareous plates ; it is moreover worthy of remark that the soft parts are altered by external circumstances as regards their position within the shell; the *Anomia* consequently avails himself of whatever local benefits are within his reach.

Anomiæ are closely allied to the *Placunæ*; their shells are of the same fibro-laminal composition as those of the *Ostracea*, and are frequently somewhat distorted. No importance is attached to the regularity or irregularity of their valves, on account of their assuming the shape of any substance with which they come in contact.

"Eyes, and No Eyes," was the title of a pretty and instructive tale which we read in childhood's days. Our young friends will do well to obtain it for themselves, and to profit by the lesson which it contains.

Much happiness is derived from seeing things as they

really are, by closely observing the curious objects by which we are surrounded, and by seeking to understand them. When this disposition is encouraged, even a solitary walk, on the most lonely shore, is fraught with interest. Every coming wave deposits some weed or shell; the one serving, perhaps, as a small sea-car for a tiny mollusk voyaging from the deep; the other either is, or was, the home of a wondrously constructed creature, having its own peculiar sources of enjoyment, and appropriate instincts.

He who passes them by, as things of little worth, loses an innocent and laudable source of pleasure, and perhaps returns home discontented with his solitary walk; he, on the contrary, whose eyes are open to the wonders of creation, preserves the shell and sea-weed, and seeks to become acquainted with their natural history. He may find, perchance, in both, links that bind them to past ages and bring memorable events to his recollection, or such developments of creative goodness in the one or in the other, as may fill his mind with thoughts of love and thankfulness.

Family II. Pectinacea.

I see, far in the unfathomable deep,
Strange creatures at their work,—most beauteous they;
Blending the mason's and the weaver's skill,
And his who maketh ropes; though without hands,
Yet wondrously endowed, whereby to form
Their coral dwellings 'neath the raging main.

None, perhaps, among the ocean tribes are more beautiful and interesting than the *Pectinacea*: the genera *Pecten* and *Spondylus* especially exhibit a lively display of colours, and are peculiarly interesting as respects their natural history.

A considerable range of characters prevail throughout the family of *Pectinacea*; in reference to which the author of 'Conchologia Systematica' has remarked, that in the genus *Pedum*, for example, the animal attaches himself by a byssus, which passes through a notch on one side of the hinge, and the shell is moreover strongly characterized by a dorsal area, formed by the valves as they advance in growth. In the genus *Pecten* this area or disc entirely disappears, the byssus is said to be very small, and the shell does not become attached, except in a single instance. In the *Plicatula* and *Spondylus* a change of character is obvious, in the strong cardinal teeth, and a remarkable dorsal area or disc.

The shell pertaining to this beautiful family of mollusks is either free or attached by one valve: it is often inequivalve, somewhat irregular, and generally auriculated at the base on each side. The ligament is either internal or semi-internal, inserted in a central pit or groove, and the animal is not always provided with a byssus.

Five genera pertain to this family—*Pedum*, *Lima*, *Pecten*, *Plicatula*, and *Spondylus*.

The organization of the *Pedum* is intermediate between that of *Avicula* and *Spondylus*. Like the former it is provided with a strong tendinous byssus, exserted in the same direction, and the shell, like that of the latter, no longer exhibits a particular fibro-laminar structure, but forms a solid umbonal area. Its habits, however, differ considerably from both, as many of the family are found partially buried in madrepores, or in crevices of their own boring.

The naturalist has much to learn respecting the uses and relative construction of these singular mollusks. They dwell beneath the waters, and he may look with prying eyes on their retired abodes without discovering either their going out or coming in, or yet the means by which they obtain their food. Thus much we know, however, that the world of waters teems with delighted existence; that tiny mollusks

are objects of no small interest to their parents; that those who are of full age range amid coral groves, and beneath clusters of beautiful sea-weeds, that heave and sparkle in their watery growing-places; and that perchance many an aged mollusk looks placidly from out his quiet cell on the active movements of his younger brethren. It may be that, as dumb people converse together with their fingers, and ants communicate their hopes or fears by tapping one another with their antennæ, the creatures of which we speak hold converse with their friends by the same means.

The shell of the *Lima* is uniformly white, covered with a brown horny epidermis. The valves are mostly disposed in ribs, diverging in symmetrical order from the umboes to the margin, and are generally more or less imbricated externally. It may further be described as longitudinal, nearly equivalve, auriculated, and gaping on one side.

A beautiful coral nest is formed by the indwelling mollusk for his own residence. And why is this? Because he is only partially protected by his elegantly-constructed shell, a considerable portion, and that unquestionably the most delicate and highly embellished, being left exposed. The defenceless *Lima* is, therefore, endowed with multifarious talents whereby to form his nest, and these he successfully

employs. He collects small branches of white coral, and arranges them together with considerable taste and judgment; thus forming a kind of hermitage, pleasing to the eye, though not efficient, because the first wild wave might scatter it abroad. A need, therefore, exists for binding the fragments of coral together, and this the little architect readily effects by means of cordage, home-made, and for which he is not indebted to any extraneous assistance. The mention of cordage naturally brings to mind the manufacture of rope or twine, and the different hands that are employed; but the little *Lima* rope-maker has no hands to aid in effecting his purpose,—neither windlass has he, nor pulley, nor materials such as men would use in the forming of strong cables. And yet, though wanting in all these, he sets to work, and spins firm threads, which he skilfully entwines among the coral fragments till they are firmly bound together. The exterior of his hermitage is rough, and merely resembles a tuft of small-branched white coral, which the waves have broken from their growing-place; but this does not signify, it is even advantageous to the occupant, as serving to baffle the vigilance of his marine enemies. The interior, on the contrary, is scrupulously neat, and well finished; every interstice is filled up with a kind of mortar,

over which a web-like tapestry is suspended. And thus, while the cordage already mentioned is employed to bind the materials together, and every rough point is rendered exquisitely smooth, the whole is covered with web-like hangings, after the manner in which the tapestry bee adorns her cell, and renders it both warm and comfortable. The architect is thus protected from injury, and the fringes with which he is decorated cannot become entangled with the projecting edges of the coral. All within this curious dwelling is in consequence smooth and highly wrought: though rugged without, it is internally beautiful, and contains a joyous inhabitant. Concerning his domestic occupations within the dwelling which he has so admirably made, we cannot write; they are doubtless such as befit his watery location, and may partly consist in repairing his tapestry hangings when required, or in strengthening the cords that bind his domicile together. An angler, too, is he; his fringed appendages serve, it is conjectured, for fishing-rods, to catch his prey. Those who look down through clear calm waters that often cover his marine abode may chance to see the fairy-looking *Lima*, swimming about with great rapidity. Like his neighbour the Scallop, he repeatedly opens his valves, and then, suddenly closing

them, expels the water which they contain, and is impelled either onward or upward, according to his necessities or inclination, by a succession of jerks or jumps. While thus progressing through the water the brilliant orange fringework, which is altogether outside of his elegantly-constructed fragile shell, resembles the tail of a comet; and perhaps, among molluscous animals, whether as regards the shell or its inhabitant, none are more pleasing to the eye than this admirable little creature. Kings and great men, in ancient times, caused their state-rooms to be covered with superb and pictured hangings from the looms of Gobelin and of Arras; and further back, in looking through the vista of past ages, courtly dames are seen employed on the most elaborate productions of the needle.

> "Then queens their hours bestowed
> In curious works. The whirling spindle glow'd
> With crimson threads, while busy damsels cull
> The snowy fleece, or twist the purpled wool."—*Homer.*

But the *Lima* wrought in the earliest ages of the world; and thus elegantly has a modern writer spoken of the little craftsman:—"I doubt not that, from the time when Noah's ark rested on the mountain of Ararat, the forefathers of the

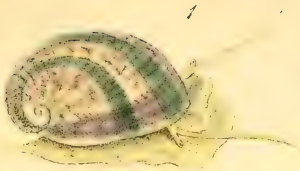
beautiful little *Limas* constructed their coral cottages, and lined them with well-wrought tapestry, in the peaceful bay of Lamlash."

Pectens are very numerous, and may be divided into groups or sections, according to the inequality of the ears and valves. In some, both valves are flat; in others, both are convex; in others, again, one valve is flat, the other convex.

They are commonly known by the name of *Scallops*, but their original and most popular title is that of the *Combs*; *les Peignes* of the French; *Pectines* of the Latin; and Κτενες of the Greek. Their shells exhibit a most vivid array of colours, and the upper valve is usually more beautifully painted than the lower; the umboes approximate without the least indication of any disc or area, and in this respect they differ from all others of their brethren.

Some few species are provided with a byssus, although invariably small; and the *Pecten pusio* is generally found attached to some marine substance by the lower valve.

Pectens are very generally diffused. They are met with on the shores of almost every ocean. Pilgrims found them on the shores of Palestine, and placed them in their hats, as tokens that they had crossed the sea on their way to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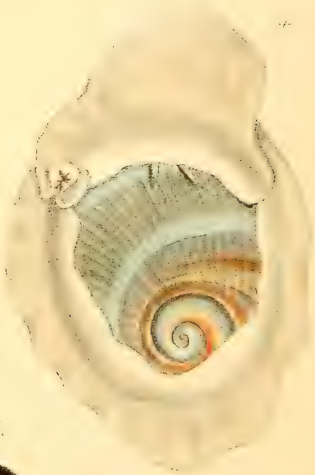
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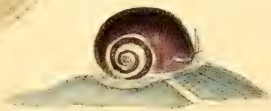
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the Holy Land, or some distant object of devotion. Hence they are still preserved in the armorial bearings of several distinguished families.

The species journey occasionally to considerable distances from their native element, and are not unfrequently deserted by the tide. How, then, it may be asked, is it possible for the creatures to return? That Being who denies to this gradation of His works those facilities for locomotion which He assigns to almost every other, has not left them without a substitute. They expand their valves, and then close them with a sudden jerk; an impulse is thus given which enables them to move to the distance of four or five inches, and by a continual repetition of this simple act, Scallops gradually progress till they reach the water. Nor is this all. They are sometimes exposed to the rude tossings of the waves, and their small vessels are consequently liable to be broken against the rocks: but to obviate the possibility of such a disaster, those which pertain to rough seas are endowed with the faculty of spinning threads, as above noticed, by means of which they attach themselves to large marine pebbles, rocks, or pieces of timber, and are often found

safely moored in places upon which they have been hurried, like shipwrecked mariners, by the fury of a tempest.

Nothing, then, is wanting to this feeble creature: the same Almighty Creator who hurls the tempest, provides for its security amid the fury of the storm. And yet, this is but a single member of a numerous family, and the family itself but a small colony of the myriads of shell-fish that extend from the Line to the Frozen Ocean.

When reflecting on those tribes which, like insects, undergo a series of transformations, we are accustomed to associate in our minds the idea of the greatest locomotive power with the most mature and perfect condition of each. But such is not the case, and Mr. Forbes has recently shown that many kinds of Testacea, and among these especially the Pectens, possess, when young, the means of swimming from one region to another, which are denied them when they attain their full development.

The curious instincts of these interesting shell-fish most probably suggested the poetic chariots of the sea-gods, who were fabled to ride triumphantly in shells drawn by Tritons. Such was the car of Neptune, as we find in Virgil, and on a medal of Claudius:

"High on the waves his azure car he guides;
Its axles thunder, and the sea subsides.
The monster whales before their master play,
And choirs of Tritons crowd the watery way:
The martial powers in equal troops divide
To right and left; the gods his better side
Enclose; and, on the worst, the nymphs and nereids ride."

How sterile is the imagination of the poet when compared with the infinite variety of creation! The loftiest inspirations of his muse are frequently suggested by the humblest of created beings; and from this inexhaustible source the ancients derived their most poetic illustrations. Shells are also represented on modern coins: among some of the most curious is one with a bust of Sebastian, king of Portugal, and a kind of bivalve shell floating on the ocean.

The *Spondylus plicatus* of Linnæus was selected by Lamarck as a type for the formation of the genus *Plicatula*, in consequence of the shell exhibiting certain characters intermediate between those of the genera *Pecten* and *Spondylus*. Like the former, it has neither basal area nor disc; like the latter, it becomes attached by the lower valve, and the hinge is furnished with teeth.

Aristotle and Galen were equally delighted with the

beauty of the *Spondylus*, or Thorny Oyster. The shell of this interesting genus is thicker and of more irregular growth than that of *Pecten*; it is uniformly attached by one or both valves, and a marked change is perceptible in the hinge, which is provided with strong teeth, and a solid umbonal area.

The animal inhabitant apparently possesses abundance of calcareous matter, for as the shell advances in growth, the valves are composed of several distinct plates, deposited one upon the other in progressive order. In the *Spondylus varius* this laminar structure is very remarkable; the plates are so irregularly secreted as to admit water, which becomes stationary by the sealing up of the last plate. The transparent Water Spondyls are therefore highly estimated.

The shell of the *Spondylus* is attached, inequivalve, somewhat irregular, and more or less auriculated. The outer surface is rarely smooth, and beautiful are the varieties of external development whether of spines or foliations; the colours, also, are exceedingly bright and vivid.

While comparing this gracefully-decorated shell with others of equal vividness, whether in cabinets, or placed by the waves within our reach, we shall have occasion to observe that the coverings of different mollusks bear not

only an obvious reference to their necessities, but are often extremely beautified; and that the latter, independent of the former consideration, or, indeed, of any other with which we are acquainted, is evidently designed by their Creator to embellish the dwelling-place of man.

Thoughts suggested by the sublimity or minuteness of creation "should expand our theology," as Dr. Chalmers well observed, "and lead us to contemplate our Heavenly Father in the wonders and works of creation, as well as in the economy of grace. Let us participate with the Psalmist in admiring the beauties and characteristics of the grand visible panorama around us, consisting of the earth in the fulness of its riches, and of the sea with a zoology of its own."

Family III. Aviculacea.

> It may not be
> That aught more perfect than the globe of light
> Is found on earth, nor yet beneath the waters.

The shell of the family *Aviculacea* may be described as irregular, thin, fibro-laminal, and sometimes foliated on the outside. The hinge is edentulate, having a strong ligament inserted in one or more variously-shaped pits, and the

muscular impression is sometimes compound. The mollusk fixes himself with a byssus, which passes out through a notch in the hinge or front margin.

The *Aviculacea* are divided into five genera—*Crenatula, Perna, Malleus, Vulsella,* and *Avicula.*

Several species belong to the genus *Crenatula,* but only one appears to have excited the attention of early naturalists.

The genus *Perna* possesses a byssus, and is remarkable for a peculiarity of structure which the shell exhibits in the hinge. The hinge consists of a broad flat surface in each valve, cut across by a parallel series of grooves, in each of which, as in the hollow concavities in the shell of *Crenatula,* is inserted a separate portion of the ligament. But the ridges which are left by the cutting of the grooves do not interlock, but shut flat upon each other, the ligament occupying the interstices. *Perna* is very prolific, and is found in considerable clusters.

Concerning the *Vulsella* no particulars of interest are recorded; the shell is of the same thin, fibro-laminal composition as those of its brethren, but the animal remains unknown. Neither has it yet been ascertained whether a byssus pertains to the genus; most probably not, because *Vulsellæ* are generally found in sponges.

The *Malleus* resembles a hammer in one species, and the name was selected on account of the lateral lobes at the base of the shell giving it the appearance of an inverted hammer. This, however, only refers to the type of the genus.

A peculiar wing-shaped shell, in the typical species of *Avicula*, attracted the attention of naturalists, long previous to the time of Linnæus; that naturalist, however, included the *Mytili* with them.

The *Avicula margaritifera* is celebrated for the true oriental pearl, the Margaron, or globe of light, from which, and the Persian name *Mervarid*, which means the offspring of light, was derived Margarite, its appellation in southern Europe.

Pliny, and after him Solinus, struck with the similarity of the pearl to a drop of dew, and unable to account satisfactorily for its formation, imagined that the pearl-oyster rose every morning to the surface of the water, and expanded his shell to imbibe the dew of heaven, which assumed the texture, shape, and colour of a real pearl. This elegant hypothesis was probably suggested by the various transformations observable in nature,—such as the conversion of the nectareous juice of flowers into wax and honey.

Wild and extravagant opinions were advanced to account for the formation of the pearl by different European natu-

ralists, till the year 1717, when M. Réaumur, in a curious paper which appeared in the Memoirs of the French Academy, on the structure of both shells and pearls, conjectured with great probability (and his notions are now generally admitted), that pearls are formed of a juice extravasated out of some ruptured vessels, and detained, and fixed, among the membranes of the mollusk.

To evince the probability of this ingenious supposition, he shows that oceanic and river shells are formed wholly of a glutinous and stony matter, which oozes from the body of the inhabiting mollusk, and that, consequently, an animal furnished with vessels fraught with a sufficient quantity of stony juice to build, thicken, and extend a shell, is fully capable of forming pearl, if the juices designed for the increase of its habitation should chance to overflow among the membranes, or to fill up any accidental cavity in the animal himself.

In proof of which, he has further shown, that when pearls of two colours are discovered in the pearl-mussel of Provence, the tints of each are precisely the same with those of the shell, and that each kind of coloured pearl is found in the corresponding coloured part of the shell; thus clearly evincing that where the transpiration

of a certain juice had formed, and would have continued to form, a coat or layer of peculiar tint, the vessel that conveyed the juice had ruptured and occasioned a small deposit, which, gradually becoming hard, retained the colour of the shell. Of this the structure of the pearl, and the shell itself, is a convincing proof; for the silver- or pearl-coloured part of the Pearl Mussel is formed of strata lying one upon another; and the reddish portion, of a multitude of small, short, close, cylindrical fibres; which peculiarity of texture is also discoverable in the different-coloured pearls of the Mussels of Provence.

The intrusion of some heterogeneous substance, such as particles of sand, into the stomach of the animal, frequently produces these curious extravasations. M. Réaumur elegantly terms them the nuclei, or primary causes, of the formation of each valuable gem; as the sagacious animals cover them from time to time with exudations of pearly matter, in order to obviate the disagreeable friction which they necessarily occasion; and these exudations, as already noticed, form several regular lamellæ, resembling different strata of bezoars, though considerably thinner, and more delicate in their construction. Loose pearls are often found within the shelly covering of the *Mytilus*: when this is the

case, they have been undoubtedly rejected from the stomach of the animal, and have fallen into the cavity of the shell; whilst such as are fixed, most probably owe their origin to some internal roughness.

The observation of this curious fact most probably suggested the first idea of forcing the *Avicula* to produce pearls. It was known in the first centuries of the Christian era, and acted on by the ancient people who inhabited the coasts of the Red Sea, as we are informed by the philosopher Apollonius. "The Indians," said he, "dived into the sea after they had rendered it calm, and perhaps clearer, by the pouring in of oil; they then induced the Mussels, by means of some attractive baits, to expand their shells, and having pricked them with a sharp-pointed instrument, the liquor which exuded from the wound was received into a perforated iron, where it hardened gradually, and formed pearls of the finest water."

Modern naturalists are undecided with regard to the accuracy of this narration; yet there are various reasons to conclude, that the people who lived on the shores of the Red Sea were acquainted with an artificial mode of producing pearls; and this opinion is additionally confirmed by the method now in use among the modern Chinese, who

retain, with few alterations, the arts and customs of their ancestors. Pearl Mussels, at certain seasons of the year, congregate in considerable numbers on the surface of the water, where they open their shells, and enjoy the influence of the sun. At this period the Chinese fishermen throw into each of them a small string of beads, formed of mother-of-pearl, which, becoming coated in the course of a few months, present the appearance of real pearls. No sooner is this curious process supposed to be completed, than the Mussels are drawn up, and robbed of the treasures which they contain. The truth of this extraordinary statement is confirmed by the evidence of respectable travellers, and the result of various experiments; to which Professor Fabricius adds the testimony of having seen, in the possession of Sir Joseph Banks, several Chinese *Chamæ*, in the shells of which were contained bits of iron wire, covered with a substance of a pearly nature. These wires had evidently once been sharp, and it seemed as if the mollusks, anxious to secure themselves against the intrusion of such unwelcome visitors, had encrusted, and thus rendered blunt, the points with which they came in contact. May not, therefore, the process employed in past ages be still practised? And are we not authorized in conjecturing that these bits of iron,

which probably had slipped from the hands of the Chinese workmen, and remained in the animals, resembled the spikes noticed by Philostratus as being used by the ancient people who inhabited the banks of the Red Sea, for the purpose of pricking Mussels?

The appellation of *Margion*, or globe of light, by which the orientals designate their favourite gem, is elegantly expressive of its peculiar form and lustre. When its contour resembles a pear, it is less valuable; it is then generally used for ear-rings, and ornaments of a similar description; and the natives of the East, like the ancient Romans, prefer it to any kind of precious stone. The finest are reserved for personal decoration, while those of an inferior description are seen to enrich the trappings of their horses.

The pearl is the most perfect and beautiful of jewels. Every other owes something to the hand of man, but this emerges in full beauty from its ocean bed, where maternal Nature has silently and secretly performed her work, and given to this, her loveliest production, a lustre and perfectness which her sister Art has frequently sought to emulate, but can never equal.

Some historians have maintained that the aborigines of South America were unacquainted with this valuable gem,

but this opinion is incorrect. The Spaniards who first landed in Terra Firma, Mexico, and Peru, assert that the natives were adorned with necklaces and bracelets of the finest pearls; and this assertion, supported by the narratives of modern as well as the details of early writers, receives additional confirmation from the discovery at Basalt of the statue of a Mexican priestess, whose head-dress is profusely ornamented with gems of this kind. To which we may add the testimonies of Las Casas and Belzoni, who describe the the cruelties that were exercised on the Indian slaves and negroes employed in the fisheries; and that even as far back as the commencement of the reign of Ferdinand and Isabella the beautiful little palm-encircled island of Loche alone furnished pearls to the value of fifteen hundred marks each month. During this period the trade was so considerable that, till the year 1630, the value of these gems exported into Europe amounted on an average to eighteen hundred thousand piastres.

The pearls of Asia were introduced into Europe by two opposite channels—that of Constantinople, where the Paleologi wore garments covered with strings of pearls, and that of Grenada, the residence of the Moorish kings, who strove to emulate the splendour of the oriental caliphs.

They were preferred to those of South America, and were generally monopolized by the great, but still a vast demand existed for the latter, while the exportation of the former scarcely experienced the slightest diminution; and hence in Italy, as well as at Grenada, the island of Cubaqua became the object of numerous commercial speculations: — that especially of Lampagnano, an unfortunate Castilian, who, having obtained permission from Charles V. to fish for pearls along the coast of Cumana, was proceeding to exert his prerogative, when the colonists sent him back with this bold answer:—"The Emperor, too liberal of what is not his own, has no right to dispose of the oysters which live at the bottom of the sea." The ill-fated adventurer, finding himself unable to repay the merchants of Seville who had advanced money for his voyage, remained five years at Cubaqua, where he at length died insane.

The pearl-fishery of Cubaqua diminished rapidly towards the end of the sixteenth, and, according to the testimony of Laet, it ceased entirely about the end of the seventeenth century. Two powerfully operating causes combined in producing this effect. A Venetian discovered the art of imitating pearls, so as to deceive the most accurate observers; and the use of cut diamonds, introduced by Lewis

de Bergner, lessened the demand for pearls from the West, and rendered the South American fisheries less lucrative.

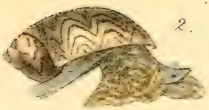
At present the pearl-fisheries of South America are principally confined to the Gulf of Panama and the mouth of the Rio de la Plata, to the coasts which surround Cubaqua, to the vicinity of Araga and Coche, and to the island of Margaretta. But these are less productive than they were formerly; the pearls, also, which they produce are not so fine as those found on the first arrival of the Spaniards;—a fact which has exercised the ingenuity of several distinguished naturalists; for who can explore the trackless basin of the sea? Earthquakes may have altered its general character, or subterraneous currents exercised some inexplicable influence on the temperature of the sea-water, or else destroyed the mollusks on which the Mussels are supposed to feed.

When Humboldt visited the once-celebrated peninsula of Araga, little remained of its population; he observed merely a group of small dwellings, which clustered round the ruins of an old castle, from whence the prospect partook of a character rarely found in the warm regions of the globe. Neither a deep and gloomy forest, nor the majesty of vegetable forms, were seen to heighten the grandeur of the ruins. They stood alone on the summit of a bare and

arid mountain, crowned with agave, columnar cactus, and thorny mimosa, the ruins resembling less the work of man than such bare and unclothed masses of primeval rock as were ruptured in the earliest convulsions of the globe.

The scenes of early life entwine themselves, as with a spell, around the heart. Thus the aborigines of Araga prefer the wild and barren spot which gave them birth to the attractions of more polished life, and support themselves by catching fish, which is extremely abundant on the coast. When asked why they have neither gardens nor culinary vegetables—"Our gardens," they reply, "are beyond the Gulf; when we carry our fish to Cumana, we bring back plantains, cocoa-nuts, and cassava."

One of these was a mulatto, the sage of the plain, who professed to know the virtues of plants, the symptoms of earthquakes, and the marks which distinguish the neighbourhood of precious metals. When the traveller entered his humble dwelling, he found him employed in sharpening arrows, and stretching the strings of his bow. Delighted with an opportunity of imparting his scanty store of knowledge, he readily communicated some interesting particulars relative to the pearls of Cumana, which, as objects of decoration, he treated with contempt; and, in order to evince



his familiarity with the sacred writings, he frequently referred to the patriarch Job, who preferred wisdom to pearls. After a long discourse on the emptiness of human grandeur, he drew from his leather pouch a few small opake gems, which he desired Humboldt to accept, enjoining him at the same time to note on his tablets that a poor shoemaker, of Castilian race, had gratuitously resigned, without a sigh, pearls which, on the other side of the great waters, were anxiously sought after.

> How many sad and serious thoughts are blended
> With thee, pure ocean gem, that comest up,
> Within thy rugged car, from deepest waters.
> Merchants of Tyre and Sidon, in past days,
> Sought to possess thee. Ocean's gem, thou purest
> Of Nature's works! what days of weary journeyings,
> What sleepless nights, what toils o'er land and sea,
> Are borne by men to gain thee!

The finest pearls are unquestionably not of occidental but of oriental growth. From the earliest period of authentic history the Indian seas and rivers were celebrated for their production. "They are rich," says a native writer, "with pearls and ambergris; their mountains are stored with gold and precious stones; their gulfs inhabited by creatures yielding ivory; and among the plants and trees with which

their shores are shaded and adorned are ebony, red-wood, aloes, cloves, and sandal, and all other spices and aromatics; parrots and peacocks are the birds of the forests; musk and civet the productions of the land." To these exotic regions we must therefore look for the finest pearls; they are brought from the island of Bahrein, or Baharem, in the Persian Gulf, from the fishery of Catisa, on the coast of Arabia Felix, and from Ceylon and Japan.

The fishery established at Manaar, a seaport in the island of Ceylon, is one of the most considerable. It commences in February, and ends about the beginning of April. During this period Candatchy, about ten miles from Manaar, presents an interesting and novel spectacle. The bay is thronged with vessels; the coast with an incredible multitude from all parts of India, consisting of persons of different complexions, countries, castes, and occupations. Here are to be seen boat-owners running to the shore with anxious faces, and looks of joy, in hopes of a rich cargo, stepping on the rocks that project into the sea, and wading as far as they can venture. There, groups of jewellers, brokers, merchants, foreigners, and natives, variously employed; some bargaining for pearls, others separating and sorting them; others, with scales in their hands, weighing and ascertaining the

value of each; others, again, hawking them about; while a considerable number occupy themselves in drilling and preparing the pearls for future use.

Occasionally a few fantastic figures are seen to mingle with the motley groups. These are conjurers, known in the Malabar language by the appellation of Pillal Karras, or binders of sharks. They are held in great veneration by the credulous natives, who firmly believe in their miraculous pretensions. Each boat is accordingly accompanied by one or two of these impostors, who frequently carry off the rarest specimens; whilst others take their stations on the shore, where they spend the day in muttering prayers, distorting their bodies, and performing unmeaning ceremonies.

Meanwhile the bay is thronged with vessels of various descriptions. The boats employed in the fishery assemble at the same period, and wait the signal for setting sail. This signal is the firing of a gun at Arippo, which is answered by a loud huzza; each boatman then plies his oar, the vessels sail out together, and reach the pearl bank, twenty miles distant, before day-break. Here they continue busily occupied, till warned to retire by the sea-breeze, which rises about noon. Again a signal gun is fired, and the respective owners hail the arrival of their boats.

A number of people are now seen busily occupied in depositing the pearl-shells in holes or pits, dug in the ground to the depth of two or three feet; or on small square places covered with mats and fenced round, where they are suffered to remain till the inhabitant of each is completely dried away: the pearls are then taken out and prepared for the market.

Each boat is manned with twenty men, and a tindal, or chief boatman, who acts as pilot. Of these, ten are employed in rowing, or in assisting the divers: the others go down alternately, five at a time, and thus enable their companions to recruit their strength, which is frequently exhausted by the excessive fatigue of diving.

The business of a diver appears extraordinary and full of danger to a European; but to the Asiatic it affords a lucrative and familiar occupation. His chief risk and terror arises from the ground-shark; a common and terrible inhabitant of the Eastern seas, and a source of perpetual uneasiness to the adventurous Indian. It, however, rarely happens that any lives are lost, for the real or imaginary appearance of a shark immediately spreads dismay throughout the whole fleet; each diver then rapidly ascends, and the boats return to Condatchy, whence they seldom ven-

ture out during the day to recommence the business of fishing.

In order to facilitate the descent of the divers, the boats are separately furnished with five large perforated stones, round at the top and bottom. These are fixed to different ropes, and each diver, when about to plunge, seizes one of them with the toes of his right foot; and from the other he suspends a bag of net-work; for these people are so extremely dexterous in the use of their feet, that they employ them, as well as their hands, for the most common purposes, and sometimes pick up the smallest stones or straws from off the ground. The diver then takes hold of another rope with his right hand; while with the left he endeavours to prevent the water from entering his nostrils as he plunges into the sea, and speedily reaches the bottom; where he eagerly commences tearing up the shells, and cramming them into his bag, which he suspends round his neck, and running from side to side, in order to render the water turbid and elude the vigilance of his marine foes.

As soon as the bag is full, or the appearance of any danger warns the divers to retreat, he resumes his former position, makes a signal to those above, by pulling the rope in his right hand, and immediately reascends.

The fatigue attendant on the act of diving is very great, and the men employed in the Pearl-fishery not unfrequently discharge blood from their ears and nostrils, on being drawn into the boat. But this does not prevent them from making forty or fifty plunges during the course of the day: for persons accustomed to the water from their infancy acquire a sort of amphibious nature, and appear to retain the same self-possession, in this deceitful element, as on land. Many other nations are equally remarkable for this peculiarity; and according to the accounts of several voyagers, the inhabitants of the South-Sea islands are such expert divers, that when a nail, or any piece of iron, is thrown overboard, they will instantly plunge into the sea, and never fail to recover it, notwithstanding the quick descent of the metal.

Each of the pearl-divers generally remains under water about two minutes at a time, though instances have occurred in which four, or even five minutes, have been devoted to this dangerous employment; and a diver from Anjanga, in the year 1797, continued during the space of six minutes.

Such is the general method of obtaining pearls; and such are the dangers connected with this adventurous

trade. Yet these costly gems have no pretensions to any actual use, as their value arises merely from their rarity and beauty, united to that general predilection for ornamental decorations which seems natural to mankind, both in a savage and civilized state.

What bringest thou up from the briny deep,
Where hidden in caves the wild winds keep
Their ceaseless revelry?
Thy hair is wet, and the dripping spray
Doth wrap thee around, as a mantle grey,
'Mid the roar of the deep, deep sea.

A few rough shells are the simple store
Which thou flingest, all faint, on the sounding shore,
Small value, methinks, are they;
Is thy life of no worth, or so small thy gain,
O Diver, that thus from the raging main
Thou bearest those shells away?

Those shells have no worth in the unpractised eye,
But within them rich pearls in their beauty lie,
Choice gifts from the deep, deep sea;—
Globes of light that are formed in each rough-coated shell,
Borne up from dark caves where the wild waters dwell,
They are pleading, O Stranger, with thee.

Family IV. Mytilacea.

It is a pleasant sight
To look on creatures formed with wondrous skill;
Perfect in all their parts; with instincts, too,
Of no mean order, by whose promptings they
Construct their beauteous homes, or moor their barks
To friendly rocks, or range from sea to sea.

The family *Mytilacea* have but little affinity with that of *Tridacnacea*, except in being provided with a fully-developed byssus, consisting of numerous filaments or silky threads, by means of which the mollusk readily attaches himself to rocks or other marine bodies; and with the assistance of a most curiously-constructed foot he can fix or displace this valuable appendage.

Shells of the *Mytilacea* may be described as being rather of an elongate form, regular, equivalve, and generally smooth. Teeth are wanting to the hinge, which consists merely of a strong marginal ligament. The muscular impression is compound, bearing the marks of one or more small accessory cartilages, probably destined to assist the muscle in counteracting the strong expanding power of the hinge ligament.

Four genera pertain to the *Mytilacea* — *Lithodomus*, *Modiola*, *Mytilus*, and *Pinna*.

The first two genera are both peculiar in their habits. The first dwells in concealed cavities, among stones and madrepores, where he excavates a dwelling, and has consequently no occasion for a byssus or anchor; the second resembles the *Mytili* in his habits, and his shell differs only in the short obtuse termination of the anterior side.

Mytili are strictly marine, and yet one or two species, which have affixed themselves to vessels, and been carried in consequence into canals or docks, have become localized in fresh water.

Several species are included in the genus, and in these what great variety! Some are smooth, beautifully marbled, and variegated with delicate colours; others are elegantly radiated with white and purple; others, again, consist of only one colour, being either black or blue, green, or brown, or yellow, coarsely ribbed, and grained with minute tubercles. Some exhibit internally a pearly appearance; others, when uncoated from a shaggy epidermis, display considerable brilliancy.

A recent traveller relates that a silvery kind of Mussel, much in request among the Indians of North America,

and called by them the White Conch, principally constitutes the breast-plate of their high priest. This breast-plate is worn on the annual festival of the natives, when this "great beloved man," as he is termed by his brethren, being clothed in a white raiment of finely-dressed doe-skin, which resembles the ephod of the Jews, enters the holiest division in their place of worship, and offers the sacred fire as the yearly atonement for the sins of his people.

A few years since, considerable-sized specimens of the White Conch were discovered in ancient Indian tumuli, in the neighbourhood of Cincinnati. They were most probably drinking-cups, or small sacred vessels, used by the aborigines in connection with sacrificial rites, or in making libations. Such specimens become of some importance with reference to the Asiatic origin of the North American Indians. Conchologists mention the shores of Asia, and those of contiguous islands, as frequented by this interesting species; its discovery, therefore, in one of the old burying-places affords a presumptive proof of the long-asserted migration of the present race of Indians from Asia. Taken in connection with other evidence, it may, indeed, be regarded as corroborative of that popular belief.

Shells of the *Mytilus* abound in the cabinets of the natu-

ralist, and serve to embellish the drawing-room and library. Persons of taste admire their tintings and construction; yet the formation of the inhabitants is still more worthy of regard than the exquisite variety of the floating citadels in which they are enclosed. Those valves, which are frequently so remarkable, close and open according to the necessity or inclination of the occupant, and this is effected by means of a fleshy protuberance of a reddish hue, divided into two lobes, and answering the purpose of feet. When, therefore, a Mussel is inclined to leave his station, the shell is gradually opened by the help of this strange member, which, assuming a new form, pushes forward, and makes a furrow in the sand, into which the shell is drawn in a vertical position. From this position he almost immediately changes into his former horizontal one; the member shovelling back the sand, and lengthening the furrow, while the animal journeys on his way with a motion which causes a continual inversion of his shell. Tracks, formed most probably by Mussels in quest of food, may be readily observed on the sand, where these creatures abound after the tide has run out: they resemble small furrows, but are rarely straight; deviating into mazes and triangles, like the course of a vessel when contending with adverse winds.

Mussels, therefore, can open and shut their shells at pleasure; remove to some distance; fasten themselves to the rocks with threads similar to those of the silkworm; respire water, like their finny neighbours; and even float upon the surface of the billows.

Now from this we might suppose that the inhabitant was at least provided with feet, in order to walk upon the sand, or that he could swim at ease, in the wide ocean, by means of such appendages as obviate in aquatic natures the necessity of wings. But the Creator, who varies means with the obstacles to be surmounted, has provided a peculiar and appropriate mechanism, which answers the purpose equally as well. The mollusk is fastened to the upper and lower shells by two white flat cords of muscular substance, which extend about two inches from the thick part of the body, and gradually decrease in size; these are capable of being contracted according to his inclination, either for the purpose of closing the doors of his impregnable citadel, or of throwing them open. Moreover, every part of this floating pavilion is inlaid with a membrane or epidermis, which, after having been saturated with water, unites so closely as not to admit the escape of a single drop.

Not less extraordinary is the creature's position, which is

so arranged as not to be inconvenienced by the opening or shutting of the shell. The mouth is singularly defended by a kind of veil, with a double flap on each side, whence the throat descends, like a thread, into the stomach, and close to this appears a curved, brown, and pointed tongue, half an inch in length; while, on the concave side, is placed a furrow, which the Mussel enlarges or closes, and probably uses in the conveyance of his food. The tongue is supposed materially to assist his motions when changing his abode in search of food, or when disturbed by an enemy; and in the middle of this member, as sentinels to direct its movements, are two bluish spots, which seem to be the eyes. Nor is this all. Another extraordinary contrivance is discoverable. The tongue is provided with a beard, or byssus, fastened by two fleshy roots, and consisting of one hundred undivided parallel lines, an inch in length, of a dark-green tint, having metallic lustre, and terminated by a circular gland, resembling the stigma of many plants. But what, it may be asked, can be the use of such a singular appendage? As the tongue compensates the want of feet, so the byssus answers the purpose of innumerable hands. It enables the Mussel to attach himself to rocks and corals, and to adhere when young to the parental shell. It even answers the

purpose of a line or hook, and is capable of being extended or contracted, in order to entrap sea-insects or small fish. There is still another admirable contrivance, which compensates for certain deficiencies in the animal economy. The *Mytilus* frequently buries himself in the sand, in order to escape his marine enemies. How, then, is he supplied with air and water, both of which are essential to his welfare? In common with most of his burrowing kindred, he has breathing tubes, which he projects through the sand, and thus a communication is maintained with both those elements

> "which equally sustain,
> Like mighty pillars, the frail life of man."

"Go to the ant, thou sluggard," said Solomon; "consider her ways, and be wise." Let the unbeliever in the superintending providence of his Creator examine the structure of this insignificant creature, and he will be constrained to acknowledge, unless blinded by prejudice, that moral cataract of the human mind, the hand of Deity to be conspicuous even here.

The female of the common Mussel generally lays her eggs in small cavities on the outside of her shell, to which she attaches them by means of a glutinous substance; but it is not certain that the numbers which are often seen ad-

hering were all deposited by the inhabitant, as this species, like the cuckoo, frequently appropriates a neighbour's shell for the temporary reception of her offspring.

The migration of testaceous tribes is a subject of peculiar interest. Some of the shell-bearing mollusca lay their eggs in a sponge-like nidus, wherein the young remain enveloped for a fixed period after their birth, and this buoyant substance floats like the weed of ocean. Others are affixed to sea-weeds; and others, light as the finest grains of sand, ride on the billows, and become deposited wherever the currents find their way. *Serpulæ* are often found adhering to floating cocoa-nuts, and even fragments of pumice. Such species of mollusks, on the contrary, as inhabit lakes and rivers usually attach their eggs to leaves and sticks, which, having fallen into the water, are liable to be swept away from tributary waters to the main streams, and from thence to every part of the same basins. Hence it happens that certain species migrate during one season of the year from the commencement of the Mississippi to countries bordering the sea, at the distance of many thousand miles.

A considerable number attach themselves to the bottom of ships, or nestle in holes, which the *Teredo,* or ship-worm, has perforated. By one such method the *Mytilus polymor-*

phus, previously known only in the Danube and Volga, may have been brought to the commercial docks in the Thames, and to Hamburgh, where the species is now domiciled.

The shells of Crabs and Lobsters are often appropriated to the same purpose by sagacious Mussels and their relatives when about to migrate. A Lobster was taken alive in a drag-net, of which the shell was covered with a colony of Mussels; and within a recent period a large female Crab, loaded with Oysters, and bearing also *Anomia ephippium* and *Actineæ,* was captured off the English coast. The Oysters, seven in number, included individuals of six years' growth, and the two largest were four inches long and three-and-a-half broad. Both the Crab and Oysters were seen alive by Mr. Robert Brown; in reference to which Mr. Broderip observes, that "the crab, who was apparently in perfect health, could not have cast her shell for six years; whereas some naturalists assert that the species moult annually, without limiting the moulting period to the early stages of the creature's growth."

A right joyous party, doubtless, were those incongruous voyagers, though of different forms and habits; a silent company assuredly, for none among them could excite con-

tention with harsh words. We know not what an amount of placid enjoyment might have been shared by each, nor yet how they looked on the rippling waters of the calm blue sea, slightly heaving and sparkling in the sunbeams, and continually presenting them with plentiful supplies of food. No need had they to lay in stores for a long voyage, even if that voyage extended "from sultry Indus to the pole;" the winds and waters ministered to their necessities, as also to those of the living vessel which thus carefully conveyed them. But, alas! some merciless collector saw the ship and freight making their way upon the deep, and, no sooner seen than done, his hands, like those of Scylla, were stretched forth to secure them as a lawful prize. And thus, if not denied the gift of speech, might some hapless survivor speak concerning the insatiable avidity of his unpitying grasp:—

"He makes the huge leviathan his prey,
And all the monsters of the watery way;
The swiftest shell-fish of the azure plain
Now fills her sails, and spreads her oars in vain.
Thus from some rock that overhangs the flood
The silent fisher casts the insidious food;
With watchful care he waits the finny prize,
And sudden lifts it quivering to the skies."—*Odyssey.*

We learn, however, from this example, the mode by which the oyster may extend over every part of the ocean where the crab wanders; and if she is at length cast by the waves on some coast where, instead of sand and pebbles, spreads out a deposit of fine mud, the foundation of an oyster-bank may be readily laid. Mussels in like manner are conveyed to far distant regions, where they furnish a supply of food to different kinds of fish, marine birds, and animals.

But are not the Mussels defended with a testaceous coating? How, then, is it possible for a bird to open and devour them? These instinctive creatures pounce upon their prey, when left uncovered by the efflux of the tide, and mount with it to a considerable height; they then let go their hold, the shell is broken by the violence of the fall, and the inhabitant is easily extracted.

Monkeys also devour Mussels, as well as other shell-fish, in considerable numbers. They watch the ebbing of the sea, and whenever an unfortunate Mussel opens his shell for the purpose of imbibing or rejecting water, a stone is immediately slipped in, which prevents the valves from closing, and renders him an easy prey to his sagacious adversary. Birds, also, occasionally avail themselves of this

propensity in the Mussel to open his shell, but not always with equal success. A crow, seeing one day an oyster with his valves expanded on the beach, incautiously darted her claw into the open shell, with the intention of dragging forth the inmate; but the oyster, aware of her design, instantly closed his doors, and in so doing took the thief prisoner. A gentleman found them in this situation, and made a double capture.

The genus *Pinna* is one of considerable interest, not only on account of early poetic associations, but as regards the new and peculiar structure of the shell, which, instead of being solid and entirely coated with a firm nacre, is composed of numerous perpendicular fibres, arranged either in one laminal plate, or in several, one upon the other; the nacre itself is alone deposited in the central concavity of each valve, the home of the indwelling mollusk. The extended growth of the shell beyond the seat of animal existence, is elastic during the life of the occupant, but when taken from the water and dried, it becomes hard and brittle.

At least twenty different species are included under this division: and here it is not unworthy of remark, that, however individuals may vary in size and colour, the usual form of their testaceous coatings always resembles that

of the larger species of Mussels, being long and tapering towards the opposite extremity. They are, also, generally brittle and horny, and are occasionally enriched with a steel-like blue or copper-colour. Some peculiarity in the animal inhabitant uniformly furnishes a clue to his mode of life. The construction of the *Pinna* points out his adaptation to smooth waters and sheltered bays; and, though generally found in the Mediterranean, Indian, American, Atlantic, and Red Seas, they are seldom seen on bold and rocky coasts, exposed to the furious surgings of the tides. The classic shores of the Mediterranean are consequently amongst their favourite resorts; and hence the rocks near Cape St. Vido, where once stood an abbey of Basilican monks, as well as the shores of the Mare Grande, are completely studded with this interesting shell-fish.—

> "Thousands of spinning worms,
> That in their green shops weave the smooth-hair'd silk
> To deck her sons."

They are elegantly termed silkworms of the ocean, in allusion to the fine silky beard, or byssus, by means of which they moor themselves firmly to the rocks, or else allure small fish by the floating or trembling of the filaments

in the water. This they possess in common with the Mussel. But instead of a hundred undivided parallel and flattened fibres, terminated by a circular gland, furnished with absorbents, and growing from the body of the animal, we have here a machine as incontestably mechanical as that of a wire-drawer's mill. The *Pinna* is provided with an extensile member like a finger, and this contains a glue, which the animal protrudes at pleasure, by means of a variety of minute perforations in the tip. This glue, or gum, as in the instance of the common spider or the silkworm, having passed through these apertures, becomes threads of almost inperceptible fineness; and these, when joined, compose the silk which is so much valued by the Sicilians. But the animal first attaches the extremity of the thread, by means of its adhesive quality, to some crag or pebble of unusual size; and when this is effected, the *Pinna,* receding from that point, draws out the thread through the perforation of the extensile member by a process which Paley, in describing the similar operations of the terrestrial silkworm, justly compares to the drawing of wire. One difference alone exists. The wire is the metal unaltered, except in figure; whereas, in the forming of the thread, the nature of the substance is somewhat

changed, as well as the form; for, as it exists within the worker, it is merely a soft and clammy glue, the thread acquiring, most probably, its firmness and tenacity from the action of the air upon its surface at the moment of exposure. This property is, consequently, a part of the contrivance.

The mechanism itself consists of the extensile member which the animal propels at pleasure, of the reservoir in which the glue is collected, and of the external holes communicating with it; while the action of the machine is seen in forming the thread, analogous to that of making wire, by forcing the prepared material through holes of proper dimensions. The secretion is an act too subtile for our discernment. But one thing answers to another—the secretory glands to the quantity and consistence required in the secreted substance, and the reservoir to its reception; while the outlets and orifices are constructed, not merely for relieving the reservoir, but for manufacturing its contents into a form and texture of great external use to the life and functions of the *Pinna*. Moreover the texture is not only essential to the welfare of the inhabiting mollusk, it also constitutes an important article of commerce among the Sicilians; for which purpose considerable numbers of *Pinnæ*

are annually fished up in the Mediterranean, from the depth of twenty or thirty feet. An instrument called a cramp is used for the purpose; it is a kind of iron fork, with perpendicular prongs, eight feet in length, each of them about six inches apart, the length of the handle being in proportion to the depth of the water; for, notwithstanding the extreme delicacy of the individual threads, they form such a compact tuft, that considerable strength is necessary in separating the shells from the rocks to which they adhere.

This tuft of silk, termed by the Sicilians *lanapenna*, is then broken off, and sold to the countrywomen, who wash it in soap and water. They then dry it in the shade, straighten the threads with a large comb, cut off the useless root by which it adhered to the animal, and card the remainder; by these means a pound of coarse filaments is reduced to about three ounces of fine thread. This is fabricated into various articles of wearing apparel, such as stockings, caps, gloves, and waistcoats. The web is of a beautiful yellow-brown, resembling the burnished gold hue which adorns the backs of some splendid flies and beetles. A considerable manufactory is established at Palermo; the fabrics are extremely elegant, and vie in appearance with the finest silk. In the year 1754 a pair of stockings were presented to Pope Bene-

dict XV., which, from their extreme fineness, were enclosed in a small box, about the size of one for holding snuff. A robe of this material is mentioned by Procopius as the gift of a Roman emperor to the satrap of Armenia.

It is even conjectured, by some writers, that the fine *byssus* produced in India, Egypt, and about Elis, in Arabia, was no other than the threads of this interesting shell-fish, from which the richest apparel was anciently made, and afterwards dyed purple, for the sacerdotal vestments of the Jewish and Egyptian priests.

The animal inhabitant of the *Pinna marina* is a blind slug, surrounded with numerous enemies, and particularly obnoxious to the *Sepia*, or Cuttle-fish, who watches the motion of the *Pinna*, and no sooner does the latter open his bivalve shell, which occasionally exceeds two feet in length, than he rushes upon him like a lion. It will naturally be asked, how such a blind, defenceless creature can either procure food, or protect himself from the attack of his implacable enemies? Nature uniformly redoubles her exertions in favour of the weak; or rather, it may be said, that the God of Nature offers, by this new and affecting compensation, an additional reason for unreserved confidence in Him. A kind of crab-fish, naked like the Hermit,

W. Wing, lith.

and very quick-sighted, is the constant companion of the *Pinna marina*. They live and lodge together in the shell, which belongs to the latter. When the *Pinna* has occasion to eat, he opens his valves, and sends out his faithful purveyor to procure food. If any foe approaches, the watchful Crab returns with the utmost speed and anxiety to his blind protector, who, being thus warned of danger, shuts his valves, and escapes the rage of the enemy; when, on the contrary, the Crab loads himself with booty, he makes a gentle noise at the opening of the shell, which is closed during his absence, and when admitted the two friends feast together on the fruits of his industry. This curious fact, although well known to the ancients, escaped till lately the observation of the moderns. Aristotle tells us that the *Pinna* kept a guard to watch for him; that there grew to the mouth of the *Pinna* a small parasite, having claws, and serving as a caterer, resembling a crab, and termed the *Pinnophylax*. In like manner, Pliny mentions a singular animal called *Pinnotheres*, which, he says, is liable to injury, and therefore prudently hides himself in the shell of oysters. He also speaks of the *Pinna* as belonging to a genus of shell-fish, produced in muddy water, and constantly attended by a companion.

"One room contains them, and the partners dwell
Beneath the convex of one sloping shell;
Deep in the watery vast the comrades rove,
And mutual interest binds their constant love:
That wiser friend the lucky juncture tells,
When in the circuit of his gaping shells
Fish wand'ring enter; then the bearded guide
Warns the dull mate, and pricks his tender side.
He knows the hint, nor at the treatment grieves,
But hugs the advantage, and the pain forgives:
His closing shell the *Pinna* sudden joins,
And 'twixt the pressing sides his prey confines;
Thus fed by mutual aid, the friendly pair
Divide their gains, and in the plunder share."—*Oppian.*

Modern discoveries have withdrawn this fact from among the fables of ancient days; and it is curious to observe how, in some cases, the study of nature gradually dispels the consecrated delusions of ages, and reduces to the level of ordinary facts what time had invested with all the characters of the supernatural; in others the correctness of statements hitherto considered fabulous, or highly embellished by poetic fancy, are proved by modern naturalists.

Surely it is impossible to contemplate the history of the *Pinna* without mingled emotions of surprise and pleasure. The conchologist may view it merely with a reference to his favourite pursuit; but the Christian philosopher regards it

as a striking proof that the tender mercies of the Creator are over all His works. That gracious Being, who sustains the planets in their courses, takes care of the helpless *Pinna*, and assigns him a companion, who, himself houseless and defenceless, amply compensates, by activity and quick-sightedness, for the deficiencies of his blind protector.

Family V. TRIDACNACEA.

> Methinks that quiet spirit,
> Which broodeth o'er the rocks and sounding shore,
> Blends with the awful rushing of the waters,
> And fills this lonely spot with holiest musings.

The *Tridacnacea* exhibit a well-defined assemblage of characters, and may be easily distinguished. They are generally of considerable size, living attached to rocks and corals, by means of a strong byssus; and as they are readily found in open places, they are brought to this country in great abundance. Their shells are solid, transverse, equivalve, and more or less gaping at the lunule, beneath the umboes; the ventral or outer margins of the valves being deeply sinuated, and interclosing with each other. The muscular impression is duplex or bipartite, situated about the centre, and spreading nearly to the ventral margin.

Two genera belong to this family—*Tridacna* and *Hippopus.*

One species, the *Tridacna gigas,* is by far the most gigantic of all mollusks; its muscular powers are said to be very great, and the shell is so large and ponderous, as to exceed occasionally five hundred pounds in weight. This gigantic shell is believed to have been noticed by Nicander, and some of the early Greek poets.

The *Tridacna gigas* is doubtless referred to by Linnæus, when he spoke concerning a specimen that weighed four hundred and ninety-eight English pounds, of which the inhabitant afforded a plentiful supply of food to a large company of men, and the sudden closing of whose valves was sufficient to snap a cable asunder.

A manuscript in the library of the late Sir Joseph Banks, also notices the dimensions of a specimen brought from Sumatra, and preserved at Ano's Vale, in Ireland: the weight amounted to five hundred and seven pounds; the largest valve measured four feet six inches in length, two feet five inches in breadth, and one foot in depth. A shell of the same species forms the baptismal font at the church of St. Sulpice at Paris: it was presented by the Venetians to Francis the First.

Large pearls are occasionally found in the *Tridacna gigas*. One, exhibited at Sir Joseph Banks's, in June 1804, was valued at two or three hundred pounds. The colour of this extraordinary shell is of a dirty white, or yellowish or reddish brown. The hinge is furnished with a cartilage of a dull brown colour, but, when cut and polished, is beautifully iridescent as the opal.

The genus *Hippopus* presents a curiously imbricated shell, of which the interior is lined with clear white enamel, transparent as alabaster. The muscular impression is not spread out towards the central margin, as in the previous genus: these, although not very important differences, are peculiar and unchangeable.

Family VI. Chamacea.

> Who has not heard of tiny folks that dance
> In green and gold, when shine the bright moonbeams,
> Or sportive elves, that take all curious shapes
> Of fantasie? But far less beauteous they,
> Less wonderful, than those that calmly dwell
> Beneath the waters.

Next in the descending scale is the Order *Bimusculosa*, which includes such mollusca as are attached to their shells by two adductor muscles, the marks of which attachment

are exhibited in the interior, at the lateral extremities of each valve.

The shell of *Chamacea* is characterized as being irregular, inequivalve, and always attached by one valve to some other substance. The hinge consists of a single tooth, though occasionally obsolete. Two genera only are referred to this family, *Etheria* and *Chama*; the former inhabiting rivers, the latter peculiar to the sea.

The genus *Etheria* represents a small group of mollusks, inhabiting the great rivers of Central Africa, having a shell somewhat resembling that of the *Ostræa*, though differing essentially in being fluviatile, and in possessing two internal muscles of attachment.

When the genus was first established by Sowerby in his 'Genera of Shells,' he suspected it to be an inhabitant of fresh water, in consequence of the shell being eroded, like that of the *Naiades*, and the outer surface being often covered with the remains of those ovate vesicular bodies that adhere to the *Neritinæ*, and are supposed to be the eggs of fresh-water mollusks. This conjectural opinion has been singularly confirmed by recent discoveries; the *Etheriæ* having been found by Rang in the rivers of Senegal, and by Cailliaud in the Nile, as high as the cataracts of Robâtâs,

in Upper Nubia. They are described by the latter in his 'Voyage à Méroé,' as being a common article of food, and their shells are collected by the natives in order to decorate the tombs of deceased relatives.

Etheriæ, though once considered as somewhat allied to the *Naiades*, differ materially in their habits and mode of growth, being found in small clusters. They adhere firmly to one another, and present the most singular distortions of form, the nacre lining the interior being generally of a livid green colour, often raised in small blisters, and not iridescent.

No genus of acephalous mollusks, excepting perhaps the oyster, are liable to such variations in form and general aspect as the *Chama*. All parasitic genera are affected to a certain extent by irregularities in their places of attachment, but the shells of which we speak are mentioned by Mr. Reeve as more than usually distorted, by their inhabiting the crevices of rocks or corals, without an inherent power of abrading, or else absorbing, the obstacles to their natural advancement. Thus, a great difference subsists between a specimen which has grown uninterruptedly on a smooth surface, and one that has been formed within a very limited area, subject to external pressure; as also between

a *Chama* that has developed his luxuriant foliations in calm and silent waters, unaffected by exposure to light, and surrounded with nutritious food, adapted for the secretion of embellishment and colour, and one which, having to contend with the buffeting of the waves, has become stunted and misshapen. It is also worthy of remark, that while some species cluster together like bees, others adhere by the anterior side only of the under valve, and assume the form of a triangular cornucopia. Yet, notwithstanding these irregularities, *Chama* constitutes a very natural and extensive genus, distinguished by colouring and external sculpture, in the form of spines, scales, and lamellæ, that are scarcely inferior in beauty and variety to the *Spondyli*.

Chama, like all species of vivid colouring and luxuriant growth, chiefly inhabit the tropical seas. They abound principally on the coast of Central America, Peru, Mexico, Honduras, and the West Indies; some are found among the Pacific Islands, others in Australia, China, and the Philippines; and their northern limit is in the Mediterranean.

The Frondose *Chama* (*Chama frondosa*) dredged up from a rock of coral, at the depth of seventeen fathoms, off the island of La Plata, West Columbia, is pre-eminent in beauty, both as regards the bold and elegant structure of

the frondose laminæ, towering one above the other, and the vivid colouring and blending of his beauteous tints.

It seems, while looking at the Violet-mouthed *Chama* (*C. iostoma*), as if fairy fingers had been diligently employed in moulding his concentric laminæ, and embellishing the interior with a rich purple colouring. Nor less beautiful is the Foliaceous (*C. foliacea*), in which the white radiating row of scales is prominent on a dark red ground. But one of the most delicate and beautiful species, in this elaborate genus, is the Sinuose *Chama* (*C. sinuosa*) : the shell is pure white, whilst the laminæ of vaulted scales are coloured round the base in a very peculiar manner with rose-purple. We may also briefly notice that the name of the Mean *Chama* (*C. sordida*) is rendered inapplicable by a specimen having been discovered of a beautiful clear coral-red colour, sculptured throughout with fine undulating raised striæ, radiating from the umboes. Lastly, that the magnificent *C. Pacifica*, or Pacific *Chama*, obtained at Lord Hood's Island, by diving for the large *Aviculæ*, to which he attaches himself, is very peculiar in his colouring. One might almost fancy, that an artist had dashed a hasty wash of dark gamboge-orange across the vivid purple-lake that forms the chief colour, but without tinging the scales.

Family VII. Naiades.

These dwell in rivers, such as winding sweep
Through vast savannahs or primeval woods,
Where range the pumas, and the crested snake
Coils in his green abode.

This family includes a numerous and characteristic group of fluviatile mollusks, chiefly inhabiting the great rivers of America. In consequence of the gradual and perfect link which holds this family in connection, five genera are considered as best calculated to simplify all previous arrangements, namely, *Unio, Hyria, Anodon, Iridina,* and *Mycetopus.*

The animal inhabitant appears to be nearly the same in each, excepting in the genus *Iridina,* where he is provided with two tubes or syphons, formed by the prolonged union of the under portion of the syphon. The shell is inequilateral, having the valves connate or free, covered with a thick olivaceous epidermis, and more or less eroded at the umboes. The hinge is very irregular, with generally two or more very thick solid teeth, often none, and the valves are united by a strong ligament; the anterior muscular impression is always compound, showing the marks of one or more accessory cartilages of attachment.

Occasionally the hinge-margin is furnished with an irregular series of tubercles, but these, also, are often obsolete. As the name implies, they are found abundantly on river-banks, after being washed up by the tide.

The genus *Unio* includes the greater number of those which are distinguished by thick and massive teeth. No particulars of interest have transpired concerning them, and yet the *Unio occidens* is instanced by Dr. Carpenter, in his valuable Treatise on Shells, as beautifully illustrating the arrangement of the outer and inner layers. The vertical section brings into view the two substances of which the shell is composed, and most curious are they: the one an outer or prismatic layer, the other a nacreous lining, made up of numerous laminæ. Lines are also obvious, indicative of successive formations, and proving that at every enlargement of the shell the whole interior is lined with a fresh pearly lamina, in immediate contact with that which preceded it. The number of such laminæ, therefore, like successive circles in the trunks of trees, indicate the number of enlargements which the shelly structure has undergone.

A beautiful variety of patterns, minute and exquisitely varied as those produced by the kaleidoscope, are discoverable in different shells. The prismatic cellular structure

of the *Pinna*, when highly magnified, resembles Roman tesseræ; that of the *Unio occidens* may be compared to transverse lines, crossing one another; a vertical section of the *Pinna* exhibits in its breadth the semblance of water, covered at intervals with the stems of rushes; small saucers, irregularly formed and arranged, are presented in the laminæ of the shell of *Ostræa edulis*, when magnified 250 diameters. A section of the *Mya arenaria* shows, in one part, distinct cellular partitions, with large nuclear spots; in another portion of the same layer the cell-boundaries become fainter and then totally disappear. Different kinds of shells, such as the *Solen*, *Anatina*, *Trigonia*, &c., present the appearance of being covered with metallic crystallizations of great beauty, while the cellular structure of nacre pertaining to the *Haliotis splendens* reveals a perfect stratum of cells, somewhat resembling the closely-compressed scale of the artichoke. The most exquisite frost-work, in all its varied developments, cannot surpass the effect produced by the membranous residuum of the shell of *Terebratula australis*, when viewed in different lights; and those who examine a decalcified membrane of the same species, are forcibly reminded of those dancing figures that celebrate the first of May, in a kind of leafy arbours.

The shell of the *Hyria* possesses many characters in common with that of *Unio*, but may be, nevertheless, distinguished by its elongated lamellar teeth.

For the next genus, the term *Anodon*, signifying "without teeth," has been adopted, as expressive of the character by which it is distinguished from the rest of the *Naiades*. It will be found, however, that the value of this distinctive character is much reduced, as a slight indication of teeth is discoverable in some few shells. The shell is transverse, equivalve, equilateral, generally thin, covered with a green epidermis, and somewhat pearly within. When young, the shell is rather depressed, but increases in convexity as it increases in age. The hinge is linear, or destitute of teeth, with a long external ligament, and the impression of the posterior muscle is always compound.

Iridinæ are especially entitled to a generic distinction. The preceding genera have the hinder portion of each lobe of the mantle simple and free, but in this genus it is united, and forms two tubes or syphons. The shells are destitute of teeth, but the hinge-margin is furnished throughout with thickly-set tubercles. They are covered externally with an olivaceous epidermis, and are internally lined with a reddish pearl, exhibiting more or less of iridescent lustre.

The genus abounds in the Nile and other rivers of Africa, and is found in company with *Galathæa radiata*. Cailliaud observes, that the shells are used by the natives of Lower Egypt in preparing flax, and also as spoons for measuring oil and butter, and different kinds of provisions.

The *Mycetopi* have little affinity with the *Iridinæ*: the lobes of the mantle are free, and they have no syphons; their chief peculiarity consists in a long extended cylindrical foot, inflated at the extremity, and incapable of being withdrawn. The shell gapes widely at both ends, and seems to indicate a new organization in the animal inhabitant. We may presume, therefore, that the mollusk occasionally changes his abode,—that, unlike many of his brethren, who moor their floating citadels to rocks or the stems of giant sea-weeds, he is free to range at will.

Family VIII. Trigonacea.

> It may be, that in days long glided by,
> When some wild wave had cast thee on the shore,
> Tubal pass'd by, and, stooping, with quick hand
> Bore thee rejoicing to his palm-roofed home.

The *Trigonacea* may be described as having an equivalve shell, with the hinge composed of a few broad lamelliform

teeth, closely interlocking with each other. One genus, *Trigonia,* is alone referred to this family. The shell of this genus is lined with the most lustrous iridescent pearl, and the exterior is covered with ribs or furrows running longitudinally in the only recent species known, but transversely in some fossil specimens.

The shells vary in size according to their place of growth, and the nutriment that is obtained by their molluscous occupant. It may be, that this species furnished the shell to which Dryden has referred in his Ode to St. Cecilia's Day.—

"When Tubal struck the chorded shell,
His listening brethren stood around,
And, wondering, on their faces fell,
To worship that celestial sound.
Less than a God, they thought, there could not dwell,
Within the hollow of that shell,
That spoke so sweetly, and so well."

Family IX. ARCACEA.

The waves ride by, with their crests of foam,
O'er the liquid plains of their billowy home,
Bearing in sun-light their trophies along,
To the murmuring surge of the wild waves' song.

The generic type of this family exhibits a distinct and

well-defined assemblage of characters; the teeth are small and numerous, set in a straight or curved line, and the ligament is external, with the exception of the *Nucula*, in which this appendage is internal. The teeth of one valve closely interlock with those of the other.

Four genera pertain to this family—*Cucullæa*, *Arca*, *Pectunculus*, and *Nucula*.

Lamarck instituted the genus *Cucullæa* on account of a broad concamerated shelf in the anterior of the shell, for the attachment of the anterior muscle; an area or facet between the umboes, which is formed by the gradual thickening of the dorsal edges, is also very characteristic in its appearance.

The *Arca* likewise presents a distinct, accurately-defined assemblage of generic characters, whether as regards the animal or shell,—peculiar, without doubt, because the umboes are, with rare exceptions, more or less widely separated from each other, by the interposition of a large area which sustains the ligament, deposited either over its entire surface, or in superficial lozenge-shaped grooves, and this often to a considerable extent. The hinge is composed of a long rectilinear series of fine plate-like teeth, varying from thirty and forty, to one hundred and twenty or more in

number, in each valve; the teeth of one valve are closely and curiously interlocked with those of the opposite valve, and the hinge or cardinal axis, thus constituted, runs through the centre of the ligamentary area.

The genus is divided into two very distinct groups or sections, and various modifications, either as regards their composition, growth, or sculpture, arise from difference of habits in the occupants.

Such as pertain to the first division live free and unattached, their shells are mostly solid and ponderous, uniformly disposed in strongly-developed ribs radiating from the umboes, and giving a crenulated margin to the valves, by which they interlock one with the other. The shell is often inequivalve, the margin of the left valve extending beyond that of the right, and generally exhibiting a more elaborate style of sculpture, as if the left mantle of its resident was more highly organized than the right.

The second division live attached to rocks and stones, by means of a strong muscular byssus, inserted through an opening in the margin of each valve; the shell is of a lighter structure and composition, and, being seldom distinctly ribbed, the margin of the valves is not crenulated. The protection which the byssus-bearing *Arcæ* gain by their

strong power of attachment, allows of a more simple condition of the hinge; the teeth are consequently smaller, and the ligament weaker.

Here, then, is another, and very obvious instance of adaptation to existing circumstances. *Arcæ* of the first division, which are free to range according to their inclinations, possess solid and ponderous shells: they have frequently to encounter storms and rolling seas, and are consequently liable to be tossed on rocky shores. Those of the second division, which can safely moor themselves to the rocks, remain undisturbed amid all the fury of the contending elements.

An interesting monograph of the *Arca* family has been published by Mr. Lovell Reeve. It includes a considerable number of new species, with distinct descriptions of each.

The dwelling-place of very many among its members is in sand or mud, at considerable depth. The Beautiful Ark (*A. formosa*) was found in the Gulf of Tehuantepec, Mexico, calmly reposing beneath the waters; it was invested with an epidermis, of which the bristles were at least half an inch long at the end of the shell. The Copperas Ark (*A. chalcanthum*) appears as if stained with green copperas; it was first discovered by Mr. Cuming, in sandy mud at

the depth of six fathoms, off San Nicholas, one of the Philippines. A pretty little species, named by Mr. Reeve the Avicula Ark (*A. aviculoides*), was found in like manner at St. Helena, in a muddy bed ten fathoms deep. White coral, in the harbour of Mozambique, formed the dwelling of the Hankey Ark, *A. Hankeyana*, thus named in compliment to Lieut. Hankey, R.N., a zealous conchologist, whose researches on the coast of Africa have greatly contributed to the advancement of science; while the beautiful Pacific Arks (*A. Pacifica*) are found adhering to one another in bunches, and attached to rocky ground at the depth of from six to eighteen fathoms, at St. Elena, South America. Strong ribbing, and wing-like expansions of the posterior side, characterize this beautiful species. Others are found concealed beneath stones or attached to shells, and one species, the *Lithodomus*-like Ark (*A. Lithodomus*), most probably becomes imbedded in stones and rocky masses, by the aid of some powerful solvent secretion.

The delicately-sculptured Decussated Ark (*A. decussata*) in which the epidermis rises from between the striæ in scaly bristles, attaches himself to shells in the Pacific Ocean, and is found especially at the Philippines, and Lord Hood's and the Chain Islands.

The Angulated Ark (*A. angulata*), found attached to a branch of coral, at the depth of eighty fathoms, in Cumberland Bay, Juan Fernandez, much resembles a flat Indian canoe. If the "tiny people" ever pursued their midnight revels on moon-lit waves, shells of this kind of *Arca* would serve as boats, wherein to row merrily among those waving branches of giant sea-weeds, which lift up their heads above the waters.

Of equal, or perhaps superior beauty, and suggestive of poetic thoughts, is the Step-built Ark, *A. gradata*. The inhabitant moors his bark to stones at St. Elena, and the sculpture of his shell stands out in such prominent relief, as to present the appearance of elaborate carving: such, also, is the case with the *A. cælata*, of which the sculpture is so exquisite as only to equalled by the most delicate embossed carving of the Chinese.

Pectunculus.—Shell orbicular, somewhat lenticular, equivalve, rather equilateral, often covered with hairy epidermis; umboes slightly separated, intervening area small; margins of the teeth mostly crenulated. Hinge curved, teeth numerous, and oblique middle ones mostly obsolete. Ligament external.—Such are the distinguishing characteristics of this genus, including about fifty species, many of which

are new, and by far the greater portion figured for the first time in the 'Conchologia Iconica.'

A bright orange painting distinguishes the new and beautiful Gold-flowing *Pectunculus* (*P. aurifluus*), brought from the island of Capul, one of the Philippines, and found in coral sand upon the reefs. An adult specimen was singularly higher in proportion, when compared with a younger one, and the groove running half-way up the ribs of the latter, was quite obsolete in the former. Valves of the Thin-Ribbed *Pectunculus* (*P. tenuicostatus*), from Australia, are entirely covered with beautiful thread-like ribs, having the interstices filled with fine roots of epidermis, arranged in from three to four rows; while the solid and globose shell of the *P. tessellatus*, or Tessellated *Pectunculus*, from West Columbia, and found in sandy mud at the depth of ten fathoms, is very neatly tessellated with rich purple-lake spots. Ribs of the small *Pectunculus pertusus* are finely pricked, as the name implies, on each side, though bedded in coarse sand at the depth of ten fathoms, off the Philippine islands, Mindanao and Luzon, and little apparently in accordance with such a coarse dwelling-place. A glossy silken epidermis adorns the delicate *P. sericatus*, or Silk-clad *Pectunculus*, from Tortola; and dark ruddy spots, sparingly

scattered here and there upon the warm uniform ground which covers the surface, characterizes the *P. pallium*, or Mantle *Pectunculus*, from Zanzibar.

The genus *Nucula* includes two separate and distinct divisions of species. In one the shell is thin, and covered with a green horny epidermis; in the other it is thick and solid, with a dark brown epidermis: the interior of the latter differs also from that of the former, in being pearly. The umboes are contiguous, there being no intermediate area, as in the rest of the *Arcacea*, in consequence of the change in the position of the ligament. The hinge is linear, with an internal obliquely-produced pit in the centre, for the reception of the ligament; the teeth are numerous, sharp, rather recurved, set in a straight series on either side the ligamentary cavity. The muscular impression of the mantle is entire.

While recurring to the species above mentioned, we cannot avoid remarking the variety of structure and configuration, conspicuous in each. No two shells are alike in all their parts and tintings, and, doubtless, individual members of the family would exhibit an equal difference with respect to their forms and instincts, were it possible to become perfectly acquainted with them. Nay, more, we

may assume, that each mollusk has his own favourite sea-weed, to which the creature resorts, either as to a home, a citadel, or a storehouse. This is the case on land, and why not within the deep? Every insect is given to some plant, the moment it emerges to life: a leaf or flower has opened or unfolded for its reception, a blade of grass has sprung up, or some humble wayside weed holds up its tiny cups filled with nectar.

The tide continually presents to us many a curious sea-weed, freighted with small shells and their inhabitants. Those, too, who are out at sea, often derive no small pleasure and amusement from examining branches of *Sargassum*, or masses of algæ, which may be compared to minute zoological gardens, with their dissimilar occupants. Professor Scouler mentions one such, as having afforded him a pleasant occupation for some days. He noticed two or three *Serpulæ* wandering among the branches of their floating island, and that interesting mollusk, the *Hyalæa*, who employed himself in climbing the branches by means of his beautifully-grooved foot, and grazing upon the fronds; sponges of small size and curious forms attached themselves to the roots; and naturalists who have examined such floating meadows, report that sea-stars and sea-

urchins, with different kinds of shells, have been discovered, some nestling among the branches, others pasturing on the leaves, all instinct with life, and apparently susceptible of enjoyment. Even the sand which adheres to the roots, shelters many creatures of strange forms and instincts,—perfect in all their parts, extremely beautiful, yet so minute, as to require a high magnifier in order to perceive them.

Family X. Cardiacea.

It is pleasant to see how the billows run,
How they sparkle and flash to the rising sun,
Reflecting the clouds in their airy ride,
And bearing along, as with conscious pride,
Sea-weeds and shells from the wild sea waves,
Which lie hid in the depth of the fathomless caves,
Where the foot treadeth not, nor the eye may scan,
Deep, deep, from the haunts and the homes of man.

The shell of the family *Cardiacea* is equivalve, cordiform or transverse, sometimes a little gaping; and the valves are mostly characterized by being disposed in longitudinal ribs diverging in symmetrical order from the umboes to the margin. There are generally two cardinal teeth, irregular both in form and situation, and one or two

1.

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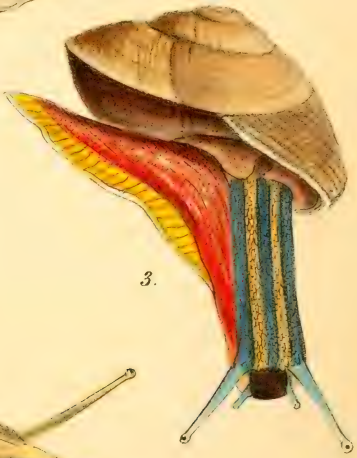

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W Wing, lith.

Reeve & Nichols, imp.

lateral teeth, but sometimes none. There are four genera—*Cardium, Isocardia, Cardita,* and *Cypricardia.*

The genus *Cardium* remains nearly as it was left by Linnæus, and is very numerous in species. The common Cockle, *Cardium edule,* may be regarded as a type of the series, their shells being more or less of a globular cordate form.

Varieties of this interesting genus are met with on the shores and in the depth of almost every ocean. He who visits the muddy, flat, and desolate shores of Hudson's Bay, may observe, for the space of at least ten miles, large numbers of the common species deposited upon the beach. They tell him of other days, and other times, when the waters, yielding somewhat of their ancient empire, receded from the place they once occupied. The same species abounds in Scotland, and is used in the Hebrides for skimming milk. Macpherson informs us, that, in the days of Fingal, they were admitted into the feasts of heroes, as the cup of their festivity, by the name of *sliga-crechin,* or the drinking-shell.

The genus *Isocardia,* though limited in species, is especially distinguished by the beautiful and novel structure of the umboes, which, instead of terminating in immediate

approximation to each other, as in the genus *Cardium* and others, divaricate in an opposite direction, and become most symmetrically involuted. The bifurcate extension of the ligament is also peculiar. Only five species are at present known: two of similar character, one British or Irish, the other Mediterranean, distinguished from each other by their transverse or globose form, with a variation in the incurvature of the umboes; and three of like affinity from the Eastern world, the specific peculiarities of which are determined by variations of form and by the varied development of the concentric ridges.

The first peculiarity that invites attention, both in the *Carditæ* and *Cypricardiæ*, as distinguished from the beautiful cordiform symmetry of the *Isocardia*, is the great dissimilitude between the anterior and posterior portions of the shell; the former being remarkably short and contracted, whilst the latter is always more or less elongated or rounded. Two simple, thick, oblique teeth are conspicuous in one valve of the *Cardita*, and one of which, varying in length according to the elongated proportion of the shell, interlocks, with a single oblique plait, in the opposite valve. It almost seems as if the young mollusk inhabiting the Allied *Cardita* (*C. affinis*) took peculiar pleasure in

embellishing his shell with prickly scales, and that the inclination ceases when advancing to middle life. Certain it is, that such decorations are found only attached to young shells.

Great variety prevails in this graceful genus: some are characterized by small zigzag lines; others are of a deep rose-colour; in others, again, the rose tint is exchanged for bright saffron-yellow, and a few irregular lines tastefully diversify the surface. Some species are very numerous; others isolated, as in the case of the *C. Cuvieri*; concerning which it is related by Mr. Broderip that, after the capture of this fine shell in the Bay of Fonseca, Central America, the dredge was kept at work in sandy mud, in eleven fathoms water, during some hours, but no other specimen could be obtained. This species far exceeds in size and beauty any that have hitherto been discovered, and is so exquisitely sculptured with broad and elevated ribs, composed of jointed knobs, as to exhibit almost the appearance of carved work.

In the *C. lacunosa*, or Guttered *Cardita*, the prickly scales which surmount the singularly compressed ribs are placed at equal distances, while each rib is so festooned from one scale to another as to resemble a miniature series of inverted arches.

The Deep-dwelling *Cardita* (*C. abyssicola*) abides, as his name implies, far beyond the reach of human ken. The species is beautifully sculptured, and especially curious, from having been dredged by Mr. Hinds, in the Straits of Malacca, at the great depth of one hundred fathoms; and whereas some species are vividly adorned with bright tints, this shell of the abyss is colourless, and looks as if cut from alabaster.

Wherever the Chambered *Cardita* (*C. concamerata*) finds a home, she carries with her a small cradle, in the shape of a curious cup-like structure, formed by a fold of the calcareous lining of the valve. This singular appendage contains her eggs, which remain until perfectly developed, and ready to disclose the complete animal and shell. A peculiar fan-shape distinguishes the minute *C. flabellum*, found at Valparaiso, South America. The same habitat, also, reveals the *C. cardita*, or Tiled *Cardita*, of which the sculpture resembles a tiled roof.

The *Cypricardia* exhibits in his hinge a more complicated character than that of the previous genus, there being three short teeth beneath the umboes, together with an elongated lateral tooth in each valve; the shell, also, is different, both in structure and composition,—as regards the first, in never

being radiately ribbed; as regards the second, in being of an opake-white nature, with little or no indication of epidermis. Among such as belong to this small genus of thirteen species, there are three which differ materially from their brethren in their habits, inasmuch as they live imbedded in shells or large masses of madrepore, after the manner of the *Lithodomi*: the shells, also, are not much unlike them in form and general appearance. They are of a peculiar tenuity and transparency, and do not present that posterior angulation which is so prominent in the typical species.

Of these, the Coral-eating *Cypricardia* (*C. coralliophaga*) is found at the depth of five fathoms, piercing and imbedded in the *Avicula margaritifera*, at Lord Hood's Island, Pacific Ocean, and within masses of coral and madrepores in the West Indies; such, also, is the haunt of the Laminated (*C. laminata*). The *C. decussata* is likewise one of the terebrating species; but the habitat is, as yet, undiscovered.

A surpassing delicacy of the ridges is characteristic of the Flesh-tinted *Cypricardia* (*C. incarnata*), discovered under a stone at low water in one of the Philippines. Instead of looking as if raised upon the surface, they appear like undulated rays of light.

Neither painting nor description can do justice to the beautiful Serrated *Cypricardia* (*C. serrata*), on account of its delicately pink serrated laminæ; nor yet to the Oblong *Cypricardia* (*C. oblonga*), vividly marked with interrupted purple lines on the posterior angle of the shell, while the anterior angle is white, more or less stained with pink. The habitat of the first is unknown; that of the other is coarse coral sand at low water.

Family XI. Conchacea.

Beneath the waters, dwelling in bright shells
Their skill hath wrought,—perchance in coral caves,
Or 'neath the shelter of those beauteous groves,
That wave and sparkle, as the waters heave,—
Conchacea fix their homes: obedient they
To Nature's laws.

This is a numerous family, and distinguished by the elegance and beauty of the shells. These pass through considerable variety of form, and their gradual modification has given rise to much speculation on their distribution into genera. In the subdivision of this family, the whole of which is included in the genus *Venus* of Linnæus, the first object has been to separate such as inhabit rivers from those that are decidedly marine.

The river *Conchacea* are not very numerous in species, neither are such as inhabit lakes, or fens and marshes. They may be recognized by having their shells covered with a thick hard epidermis, generally much eroded towards the umboes. The hinge has two or more distinct lateral teeth, which peculiarity is not discoverable in the marine.

Three genera pertain to the Fluviatile *Conchacea*, namely, *Cyclas*, *Cyrena*, and *Galathæa*; but no particulars of interest are associated with them. The last genus was instituted by Bruguière, for the reception of a singular mollusk inhabiting the great rivers of Africa.

Shells of the Marine *Conchacea* differ from those of the Fluviatile, in being mostly destitute of epidermis, and in having but one lateral tooth, often none; but the cardinal teeth are similar. An immense series of marine mollusks pertain to this division: the animal inhabitants are nearly similar, and scarcely any decided change of character is perceptible in their testaceous coverings. The five genera are, *Cyprina*, *Astarte*, *Venus*, *Cytherea*, and *Pullastra*.

Cyprina may be said to partake of the characters of *Cyrena* and *Venus*, thus serving to establish a close affinity between the fluviatile and marine sections of the family.

The genus is provided with a comparatively large shell, easily recognized by its thick fibrous epidermis.

The shell of the *Astarte* is nearly orbicular, and covered with a brown epidermis. Two divergent teeth pertain to the right valve of the hinge—one distinct, and one obsolete tooth to the left.

The shell of the *Venus* is equivalve, inequilateral, nearly orbicular, subglobose, generally rough on the outside, and closely shut. The cardinal teeth mostly belong to each valve, somewhat contiguous, and diverging from the umbo.

Three divaricate cardinal teeth are obvious in one valve of the *Cytherea*, with a somewhat remote pit running parallel with the margin ; and four in the other, one remote, diverging laterally, and almost considered as a lateral tooth, inserted in the pit of the opposite valve.

The equivalve, transverse, and equilateral shell of the genus *Pullastra*, which is much shorter on the anterior side, has, also, three contiguous cardinal teeth, sometimes a little emarginated at the point in each valve, but no lateral teeth. The muscular impression of the mantle has a large sinus, and the ligament is external, though partially concealed.

The component parts or superficies of shells are often

highly ornamental, but the properties which render them so do not apparently conduce to any other purpose. In shells and flowers, the principle of beauty holds a considerable place in their composition, and is more prominent than in animals. Why, for instance, are the shells of the genus *Cardium*, or Cockle, frequently of a dark brown colour, varied with white hollow elevated ribs? Why are those of the *Tellina*, or Tellen, so remarkable for their beautiful radiations? Why are so many species of *Venus* unrivalled in their brilliant tintings and lustre?—the rich purple *Venus mercenaria*, or Money Venus, especially, which is used by the Indians of North America to form the purple and white beads of wampums, or treaty-belts. The processes of animal nutrition, so far as we can see, might have been carried on as well under the sober coating of the garden-snail. This variety is not the effect of age, nor of any declension in the vigour of the subject, for the young and active are generally most distinguished for the brilliancy of their tints; it is evidently independent of the inhabitant. In none of the numerous family of *Testacea* is it more remarkable than in the hundred and fifteen species of this elegant genus, most of which are celebrated for the smoothness and brilliancy, as well as the rich and high

colouring, of their surfaces. Ancient poets were not inattentive to their merit: they fabled that Venus selected one of the most beautiful for the car that bore her in triumph to the shores of Paphos. Different species of the same interesting genus are used in both hemispheres for purposes of decoration. The females of the North American Indians cover with them the shoes which they use in dancing, and thus produce a sound somewhat resembling the tinkling of the little bells that were worn on similar occasions by the Jewish ladies: a mode of decoration noticed and reprehended by Isaiah, in his energetic admonition to the unthinking daughters of Zion.

Family XII. Nymphacea.

Ye have no voice, whereby to swell His praise,
Who called you into being. While the birds
Sing loud along the shores, where you have moored
Your barks, or else beneath the waters range,
That lave their homes, the trees, ye stilly dwell:
Nor voice nor sound have ye; and yet methinks
Your beauteous forms, and hues, and varying tints,
Speak in the ear of reason, praising Him
Who bade the waters teem with such as you.

Eight genera pertain to this family, namely, *Sanguinolaria*,

Psammobia, Galeomma, Tellina, Corbis, Lucina, Donax, and *Capsa.*

The shell of *Sanguinolaria* is equivalve, inequilateral, transverse, somewhat elliptic, compressed, thin, and a little gaping at both sides; the margins are curved, and not parallel. Two cardinal teeth are situated close to each other in each valve, sometimes bifid, also a prominent testaceous appendage or fulcrum on the umbonal margin. The muscular impression of the mantle exhibits a large sinus.

The genus *Psammobia,* which connects *Sanguinolaria* and *Tellina,* is chiefly characterized by the shell being always more or less angular at one end, with the cardinal teeth short, and mostly bifid.

The shell of the genus *Galeomma* is thin, small, oblongo-ovate, equivalve, equilateral, and gaping at the ventral margin. One cardinal tooth belongs to each valve; ligament small, duplex, partly internal, and partly external.

The shell of *Tellina* is transverse or orbicular, nearly equivalve, flat, and having the anterior side somewhat beaked or angular, and in general irregularly flexuose at the ventral margin. Two lateral and two cardinal teeth belong to each valve; the former, however, are often remote, sometimes

altogether wanting. The muscular impression has a large sinus.

The characteristic genus *Corbis*, instituted by Cuvier, displays a beautiful shell, which is easily recognized by longitudinal and transverse fimbriated undulations, or lamellar ridges, crossing the external surface of the valves, and diverging, also, from the umboes to the margin. The colour is uniformly of a clear white, occasionally tinged or radiated with pink.

The genus *Lucina* comprehends a natural assemblage of species, selected from the *Tellinæ* and *Veneres* of Linnæus: they exhibit a peculiar similarity of form, but are remarkable for the variety of character displayed on the surface of the interior. The hinge and teeth are irregular in their development; it is, therefore, needful to mention that the shell is generally orbicular, equivalve, inequilateral, somewhat depressed; that the umboes are small, acute, and oblique, and that the hinge has sometimes two divergent teeth, sometimes none; lastly, that one valve contains two lateral teeth, one on either side, the anterior situated near the hinge, while in the other there is but one; the teeth are, however, often obsolete. The muscular impressions of attachment are distant from each other: the anterior forms

an elongated or ligulate band. Internally the shell is often punctured with small holes.

Shells of the genus *Donax* are so strongly characterized by their form, that the genus remains nearly as entire as in the time of Linnæus. Their construction is singular, resembling a wedge, broad and thick at one end, and gradually tapering towards the other; a construction which considerably assists the inhabitant in excavating his subterranean abode. The hinge is furnished with two small teeth, and the anterior slope is generally gaping. To remedy this apparent inconvenience, a ligament is placed near the fissure, which prevents the valves from separating when the indwelling mollusk has occasion to expand them. The peculiar construction of the shell, the slight adhesion of the hinges, the gaping of the valves, the ligament which prevents them from separating, and the facility afforded by all these of readily procuring food or enabling the mollusk to change his place of abode, afford, when compared with the dissimilar construction of other shell-fish, convincing proofs of appropriate design. The name *Donax* is derived from a Greek word, signifying a reed; and a flying reed is used by the ancients for an arrow. The name aptly describes the shape, which resembles the head of a javelin. The

species delight to burrow in the sand, or among loose pebbles on the sea-shore, and are found in almost every part of the known world.

The *Capsa*, which is closely allied to *Donax*, may be described as transverse, equivalve, somewhat inequilateral, with the valves closed, and never crenulated round the inner margin, which occurs in *Donax*. The hinge is composed of two cardinal teeth in one valve, and one cardinal, with two nearly obsolete lateral teeth, in the other. The ligament is external, and the muscular impression of the mantle exhibits a large oblong sinus.

Family XIII. Lithophaga.

Ye dwell in rocks, strange creatures as ye are,
Shunning the light of day, and boring deep,
To make your homes; then, looking forth at will,
Ye watch the wild waves as they come and go,
Nor heed the fierce north wind, though howling loud
Around the old sea-wall, or rock, or cliff,
Where you are stationed.

Lamarck instituted this family for the purpose of associating a small group of terebrating mollusks, which, although inhabiting hard calcareous rocks, differ from the *Tubicola* and *Pholadaria*, not only in the growth of their

shells, but in the absence of any tube or accessory pieces. It includes only two genera—*Saxicava* and *Petricola*.

The shell of the first genus presents such a remarkable diversity of character at different periods of its growth, as to occasion the same species to be assigned to different genera. Thus the well-known *Saxicava rugosa*, when covered with small spines, has received a second name, *Hiatella arctica*; and when still younger, a third, *Solen minutus*; and not till the spines were lost, the teeth became obsolete, and the shell had assumed an irregular growth from its habit of terebrating, has it been recognized.

This curious mollusk is a most skilful borer of limestone rocks, and his operations have been carried on during such long periods as to destroy large masses, and make deep water where shoals previously existed. Hence the huge blocks of Portland stone, to which the buoys were formerly attached, were punctured in the course of two or three years on the surface, and also deeply perforated by this indefatigable miner. The sea-walls of Devonport Dockyard, which are formed of Portland stone, are likewise honeycombed and frittered away, below the low-water level of spring tides, by the same unceasing agency. Along the base of the sea-walls may be found innumerable *Saxicavæ*, nested in their

holes; higher up, their empty shells are alone discoverable; above high water, their perforations only are to be found. Hence it is assumed that all the limestone rocks around Plymouth were under water within the period during which the *Saxicavæ* were employed in their destruction.

Occasionally the rocks are protected from their aggressions by large colonies of *Balani*, or Sea Acorns, having erected on them their conically-shaped dwellings; at other times deposits of mud and sand are formed over the rocky base, and hence the operations of boring mollusks necessarily cease.

Great diversity of opinion exists with regard to the means employed by mollusks in forming their perforations: we give a few of those opinions, as expressed in the Geological section of a meeting of the British Association at Plymouth.

Specimens of perforated rocks brought from Mount Battin were regarded by Dr. Buckland as neither the work of *Saxicava* nor *Pholas*, but similar to some discovered at Boulogne, and ascertained to be occasioned by the common garden-snail. He had observed perforations of the same character at Tenby, and Mr. Topwith spoke of them as frequent in Northumberland, on the under side of projecting

mountain shelves of limestone. Holes made by the *Pholas* and *Saxicava* were noticed as being smaller at the aperture, and increasing inward as the shell grows, and assuming its shape; while those produced by snails were larger at the aperture, and so irregular in form and direction as frequently to trench one upon the other. Dr. Buckland attributed these dissimilar perforations to the agency of an acid secretion; in the *Pholas* to his solvent powers softening the rock, and aided by the rasping action of the shell; in the common snail to the secretion of the same acid in very small quantities by the foot of the animal, during his daily retreat to such habitats. Professor Owen suggested that rock-boring mollusks owed their excavations to the action of extremely minute cilia, which move incessantly and independently of the will of the animal; producing currents in the water necessary to their existence when lodged in rocks, which currents increased in power as the shell proceeded inward. Mr. J. Philips, on the contrary, alluded to the beautiful regularity of holes made by *Pholades*, in proof of their being rather formed by the shell than by currents of water. Sir H. De la Beche observed, that free carbonic acid, applied to limestone, will convert it into a bicarbonate, soluble in water; that the acid exhaled by the ani-

mal in breathing might have the power of softening his rocky dwelling-place. Dr. Buckland observed that if the perforations were owing to currents, the greater force would be exerted at the aperture, and consequently render that the larger part, while the interior of perforations made by *Pholades* at Lyme Regis, were marked by parallel circular striæ, owing to the mechanical action of the shell, which rasps away the rock, and increases the size of the cavity in exact proportion with its growth. The perforations attributed to land-mollusks were entirely chemical. Perforations in limestone rocks brought from Barnstaple to the Cambridge Museum, were mentioned by Professor Henslow as being hollowed by the chemical action of muriate of lime having converted some parts into carbonate of soda. Whether such perforations are accounted for by the action of carbonic acid, or the agency of currents, certain it is that these mollusks establish themselves not only in limestone, but trap-rocks, and those of the Old Red Sandstone.

The shells of the *Petricola*, which pertain to the same family, assume also a similar irregularity of growth, from the habit of burrowing: they may be readily distinguished from those of *Saxicava* by the teeth being more fully developed, and by having a large sinus in the pallial impression.

Family XIV. Mactracea.

"Oh! who that has an eye to see,—
A heart to feel,—a tongue to bless,
Can ever undelighted be,
With Nature's magic loveliness!"

Shells of this family are generally inequilateral, they are either closed or gaping, and the ligament is always partially or altogether internal. The following are its genera:—*Lutraria, Mactra, Gnathodon, Crassatella, Mesodesma, Ungulina, Amphidesma, Cumingia.*

The shell of the *Lutraria* may be readily distinguished by the absence of lateral teeth; it has, also, a large sinus in the muscular impression: its form is equivalve, inequilateral, transverse, oblong or ovate, and gaping at the sides.

Mactræ are very numerous, and include many rare and beautiful species, their shells exhibit somewhat of diversity, but are generally more or less triangular. The hinge is characterized by a projecting triangular cardinal tooth in each valve, with occasionally another thin sharp tooth on the posterior side, and an elongated lateral one diverging from each side of the umbo in one valve, fitting between two similarly situated in the opposite valve.

Gnathodon has a shell that is nearly oval, equivalve, and inequilateral, covered with an olive-green epidermis, and generally a little decorticated at the umboes. A lateral and two cardinal teeth are apparent in one valve, shutting between two cardinal and two lateral teeth in the other. The ligament is internal, inserted in a deep pit between the cardinal and posterior lateral teeth, and the impression of the mantle exhibits a small sinus.

Shells of the genus *Crassatella* exhibit an interesting peculiarity of character: they are both thick and solid, with an internal ligament, and rich dark brown epidermis. Eleven species were referred to this genus by Lamarck, but six only are allowed to remain. Since then, three new species have been described by Sowerby, and ten by Mr. Reeve, in the Proceedings of the Zoological Society.

Several specimens of the Swollen *Crassatella* (*C. gibbosa*) were dredged up by Mr. Cuming from sandy mud in eleven fathoms water, off St. Elena, and Xipixpi, in South America. Those figured in the 'Conchologia Iconica' are the oldest and the youngest of these; they are admirably adapted to show the different periods of growth:—when young, the valves are depressed and strongly undulated, after which they gradually assume a gibbous form, and the undula-

tions, though retaining their original formation, become pressed up to the umboes.

The *C. castanea*, or Chestnut *Crassatella*, the largest of the genus, is singularly distinguished by a smooth erosion of the umboes, as also by the bright horny nature of the epidermis. Three specimens of this fine shell are the production of New Holland, each exhibiting a marked peculiarity of character.

The magnificent *Crassatella* of the West Indies (*C. Antillarum*), dredged at the island of Margaretta, in the pearl-fisheries, has the same rich chocolate-coloured interior as the *C. undulata*, to which species it approaches nearer in most respects than any other.

The Sunbeam *Crassatella* (*C. jubar*), from the western coast of New Holland, is also deserving of especial notice. It exhibits a great peculiarity of character, in being so richly illumined with rays, as to deserve the name it bears. A solid triangular form, and bright warm rose-colour, designate the pretty little Three-cornered *Crassatella* (*C. triquetra*), of which the habitat is unknown; a peculiar singularity in the striæ, the Contrarily-striated *Crassatella* (*C. divaricata*), from the coast of Guinea. In this species, the anterior half of the shell is marked transversely, the posterior obliquely.

The shell of the genus *Mesodesma* is ovate, transverse, somewhat triangular, equivalve, rather compressed, thick, and generally closed. The hinge has two lateral teeth in each valve, between which is situated a deep spoon-shaped cavity for the insertion of a ligament. The muscular points of attachment are unequal, and the impression of the mantle exhibits a sinus on the posterior side.

Daudin instituted the genus *Ungulina* for the reception of a remarkable variety of *Mactracea*, differing in a peculiar degree from any of his brethren as regards the position of the ligament. The shell is nearly orbicular, rounded, equivalve, subequilateral, and closed at the sides. A short bifid cardinal tooth is obvious in each valve, with the addition of a small tooth in one of the valves only, but no lateral teeth; and just within the anterior margin appears an oblong narrowly-divided pit or cavity, containing the ligament, which is also divided, and so near the margin as to be partially visible externally. The muscular impression of the mantle is entire, and distinctly marked.

The genus *Amphidesma* includes a numerous and well-defined group, somewhat variable as regards their shells; for some are transverse, others orbicular, but readily distinguished by the peculiar position of a duplex ligament.

The shell is slightly inequilateral, transverse, nearly oval or round, slightly gaping at the sides: the hinge is composed of either one or two cardinal teeth in each valve, with a long narrow pit lying between them for the insertion of the ligament, which is duplex, partly external and thin, partly internal and short. The pallial impression has a large sinus.

Sowerby established the genus *Cumingia* for the introduction of a new and interesting species. The shell exhibits the unusual character of having two strong lateral teeth in one valve, and none in the other; but approximates, in other respects, to that of the *Amphidesmata*. Few instances are on record in which a naturalist has been honoured by the introduction of his name into the nomenclature of genera; but the indefatigable zeal which has been displayed by Mr. Cuming fully entitle him to such a distinction.

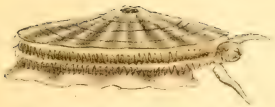
Family XV. Myaria.

Oh! the wild sea-beach
Is lone and dull when men unwilling roam,
Vex'd with the salt spray or the whistling wind,
Heedless of shells or sea-weeds: yet not lone
To him who walks with Nature, noting well
Her perfect works, however small they be.

A natural link is formed by the family *Myaria* between

the *Solenacea* and *Mactracea*, partaking of the characters of both. Their shell is generally gaping on both sides, with an internal ligament inserted in the hollow of a prominent spoon-shaped tooth in one or both valves. Occasionally, however, the ligament is external, and it is then partially covered with a small testaceous appendage. Such are the characteristics of the *Myaria*, to which eight genera pertain—*Mya*, *Anatina*, *Thracia*, *Corbula*, *Pandora*, *Anatinella*, *Myochama*, and *Cleidothærus*.

The genus *Mya*, which serves to connect this family with the *Solenacea*, is peculiarly characterized. The shell is transverse, inequilateral, gaping at both ends, and covered with a thick epidermis, which is continued at the end over two lobes, protruded by the animal in making its way into the sand. A large prominent spoon-shaped tooth is conspicuous in one valve, with a corresponding pit or cavity in the other, between which the ligament or cartilage is inserted. This tooth displays a very curious variety of cell-structure, in which a layer of large cells, occupied by carbonate of lime, disposed in a radiated form of crystallization, resembles that of the mineral called *Wavellite*. Traces of this beautiful arrangement are also discoverable in other instances.



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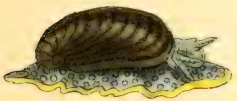

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Shells of this division are said to abound in that part of the Congo territory through which the Zaire flows into the Southern Atlantic, and are eagerly sought for by the natives, who assemble for this purpose, with their canoes, in companies of three or four hundred. Considerable numbers are also taken by the women in scoop-nets, made with the fibres of creeping plants, or from herbaceous cotton, which is common to the Congo. In some parts of the river they are caught in baskets placed along the water's edge; in others by means of poisonous plants.

The tall trees that clothe the banks of the rapid Zaire—the numerous islands mantled with thick mangroves, or covered with Egyptian papyrus, or clumps of the majestic wine-producing *Phœnix*, which cluster round the native villages—bring to mind the power of Him who caused them to spring from the earth; whilst the humble *Mya*, enclosed in a strongly-constructed shell, which enables him to resist, when needful, the action of rapid and agitated waters, tells, in accents soft as the dew of heaven, that His tender mercies are over all his works.

The true *Anatina* resembles *Mya* in his mode of life, but the shell differs in having the spoon-shaped ligamentiferous process in both valves. The chief peculiarity is, however,

a small, curved, testaceous appendage, situated before the spoon-shaped process, and, being connected with the ligament, serving to strengthen it. We may, therefore, assume that the *Anatina*, though burrowing in sand, is occasionally exposed to the rough beating of a boisterous sea.

The genus *Thracia* is characterized by an oval, oblong, and inequivalve shell; thin, fragile, and gaping at both sides. The hinge consists of a more or less prominent, horizontal, concave tooth in each valve, receiving the ligament; and the pallial impression is deeply marked.

Shells of *Corbula* are remarkable for their solidity, and peculiarity of growth; and the two valves present a greater inequality of size and general sculpture than those of any other mollusks of the class. They are mostly marine, although a few, like the *Cerithia*, are found in fresh or brackish water. Lamarck mentioned only eight species. Mr. Cuming added to them seven new ones, discovered along the western coasts of South America; and about twice that number have been described by Mr. Hinds, from collections made by himself, in company with Captain Belcher, and by Mr. Cuming, during his researches amongst the Philippines.

The Red-toothed *Corbula* (*C. erythrodon*) may be easily recognized by the rich marginal painting of the interior.

This species is found on the shores of Japan; while the *C. nucleus*, or Kernel *Corbula*, an ancient and well-known species, is the only one among his brethren that pertains to the coasts of Britain.

We may briefly mention another species, the Ovate *Corbula* (*C. ovata*), taken from the root of a fucus at Ballaugh; and, notwithstanding the indefatigable zeal with which Professor E. Forbes dredged the entire coast of the Isle of Man, the specimen figured by Mr. Reeve is the only one of the genus he ever met with, and is rendered extremely interesting by the fact, that the species has never before been discovered either on the coast of Britain or elsewhere.

The Triangular *Corbula* (*C. trigona*) must not be passed unnoticed. It may be termed a beacon-shell, indicating, by the same peculiarity of structure as the *C. faba* and *fasciata*, that the species live in situations where the water is rather brackish than salt.

Pandora is easily recognized by a certain peculiarity of form in the oblong, flexuous curve of the anterior side of the shell; as, also, by a small dividing tooth, which appears in one valve only.

The new and interesting genus *Anatinella* resembles, in its general appearance, the *Anatina*, but without any shelly

appendage; and the sinus in the muscular impression is also wanting.

Few specimens have yet been discovered of the genus *Myochama*, of which the shell, like that of *Anatina*, is furnished with a testaceous appendage; and, as in that of *Chama*, the lower valve is fixed on some marine substance. The shell is inequivalve and irregular, with two diverging cardinal teeth in each valve, in the centre of which is a triangular cavity, containing the small accessory already noticed, and connected with it by a horny cartilage. One valve is attached and flat; the other free and convex, covered with ribs or interrupted grooves, radiating from the umbocs. The ligament is thin and external.

The genus *Cleidothærus* approximates to the above, in having a similar appendage, and in being affixed by the lower valve. The shell is inequivalve, somewhat pearly internally:—the attached valve is convex; the other flat, with a small pointed tooth, fitting into a corresponding pit in the former.

Many of the preceding species are varied with bright colours, and elaborately adorned; yet some of the most brilliantly tinted dwell deep in the world of waters, occasionally even in marine caves, or in fissures of rocks.

Chemists assert that light is essential to the full development of colour in birds and flowers; hence the glorious tintings of both in tropical regions, and the gradual sobering of colour towards the poles. But this law does not universally prevail among the mollusca. Many shells, brought up by dredging from a great depth, concealed even among the mud, or imbedded in sand, present the colours of the rainbow. We cannot understand the reason why it has pleased the Most High that shells of surpassing beauty should be found, not only in the depth profound, amid groves of coral and sea-weeds, but in mud or coarse sand. We alone know that all His works praise Him, however minute or concealed. "He has made all things, and for His pleasure they are and were created."

Family XVI. Solenacea.

> No theme more curious than the perfect order
> That doth prevail wherever life extends.

The shell of the *Solenacea*, though generally elongated or cylindrical, varies considerably in form, as also in the number and position of the teeth, which, in some instances, are wholly wanting. It is generally gaping at both ends,

and the ligament is external; in some instances a fixed testaceous appendage, called the fulcrum, is obvious under the umbo of each valve. There are eight genera—*Solen, Solecurtus, Panopæa, Glycimeris, Solemya, Solenella, Glauconome,* and *Pholadomya.*

The animal inhabitant of the *Solen,* though incapable of moving forward horizontally, digs a hole nearly two feet deep in the soft sand, into which he can descend at pleasure. This is effected by means of a fleshy and cylindrical leg, which is capable of being drawn out to a considerable length, sharp at one side, terminating in a point, and alternately assuming the shape of a hook and a spade; one serving the purpose of shovelling out the sand, the other to assist the wary animal in his descent. When the *Solen* wishes to change his place of abode, the leg is put in requisition, then taking the shape of a ball, it is stretched as wide as possible. The ball prevents the creature from slipping back, while the reaction of the muscles throws him forward. He has, also, a kind of mantle in front,—a curtain before the opening of his cell, which enables him to exclude the rough beating of the tide; he is furnished, moreover, with two united breathing-tubes, about three or four inches in length, from the upper

end of the shell, and these he projects through the soft sand, for the evident purpose of maintaining a constant communication with the water.

Without these admirable appendages, the *Solen* could neither moor himself to the nearest rock, like his relative, the Oyster, nor rise upon his foot, nor raise himself from the ground. These inabilities are made up to him by the mantle and the breathing-tubes, and, above all, by the cylindrical leg, which enables him to bore into the sand. In each of these, there is a deviation from the usual construction of shell-fish,—obviously on account of the peculiar habits of the animal.

Considerable numbers are found in the European and northern seas, and especially on the coast of Normandy. Among these, a gigantic variety furnished, according to the legends of Scandinavia, a handle for the dagger of the Gaulish Cupid, who was armed with an enchanted cuirass, instead of a bow and quiver. Hence it is related, that when the queen of beauty descended on the Gallic coast, in quest of pearls for her own dress and a knife-handle for her son, a Triton, instigated by the envious Thetis, stole her apple from the rock, and bore it to the goddess of the sea; Thetis immediately broke asunder the golden prize,

and scattered its seeds along the shore; from which arose the apple-trees of Normandy, whose brilliant fruit perpetuates the memory of her triumphs and revenge.

The genus *Solen* includes only such species as have narrow linear shells, with the umboes at one end, and are commonly called Razor-shells.

The genus *Solecurtus* comprises certain natural and characteristic species, that cannot be referred either to the genus *Solen*, or to any of his relatives. The shell is equivalve, ovately oblong, transverse, gaping at both ends, and covered ofttimes externally with fine undulated striæ, crossing the valves obliquely and longitudinally. Two cardinal teeth pertain to each valve; and one, rarely two, to the other, but not interlocking as in the *Solenes*.

The shell of *Panopæa*, which is of a large size, is closely allied to that of *Solecurtus*. Oval, equivalve, inequilateral, and gaping widely at both ends, it contains a single acute cardinal tooth in each valve, with an external ligament attached to a large fulcrum, and having the muscular points of attachment distant from each other, as also a large sinus.

The *Glycimeris* presents the characteristic of its tribe, in gaping at both ends. It is equivalve, thick, transverse,

and covered with a thick black horny epidermis, passing over the edge of each valve. The hinge is without teeth, and the interior presents a strong impression of the mantle. This ligament, as in all *Solenacea*, is external, but in this genus its position is reversed, being placed on the short side of the shell, above the umboes, which are generally much eroded.

A shining brown epidermis passing over the edges of the valves, invariably pertains to the inequivalve, inequilateral, transverse, and oblong shell of the *Solemya*. This elegant shell is obtuse at the extremities: it possesses a cardinal tooth in each valve, and a callosity, running between them, receives the ligament which is seen both internally and externally.

Sowerby created the genus *Solenella* for the introduction of a new and interesting mollusk, brought from Valparaiso by Mr. Cuming. The shell partakes of the characters of both *Solecurtus* and *Nucula*, having an external ligament and large sinus in the muscular impression, as in the shell of the former; and a lateral row of sharp-pointed teeth, as in that of the latter, though chiefly on the posterior side.

The *Glauconomes* are of a light semi-pearlaceous structure,

covered with a thin, light-green, horny epidermis, in some species peculiarly wrinkled or shrivelled and projected over the margin; the hinge is composed of three irregularly-forked teeth in each valve, some of which are bifid, the valves being united by an oblong external ligament. They dwell in brackish water, in the mouths of rivers, at their confluence with the sea, and are found imbedded in the mud. As yet they have only been discovered in the eastern hemisphere; and among the several new species added by Mr. Reeve, in his 'Conchologia Iconica,' to the two that were previously known, the localities of eight are as follows:—one inhabits the rivers of China, one the Ganges, three pertain to rivers flowing into the Bay of Manila, and three to such as water the islands of Zebu, Negros, and Luzon, of the Philippines.

Some of the genus are elegantly varied. The Waxen *Glauconome* (*G. cerea*), which inhabits the Ganges, is a delicate pale straw-coloured shell, resembling wax. The Short *Glauconome* (*G. curta*), is of a shorter ovate form than any of its brethren; it is covered with a fine silken epidermis, and is beautifully tinted in the interior with a bluish salmon-colour. A variety of the Wrinkled *Glauconome* (*G. rugosa*), the largest of the genus, presents a

very peculiar arrangement of the epidermis. In the middle of the shell it lies in ridges parallel with the lines of growth, but towards the ends, especially the anterior, it turns suddenly upwards, and becomes dispersed in scattered shrivelled wrinkles.

Pholadomya, concerning which little at present is discovered, is, however, arranged with the *Solenacea*. The shell is thin, rather hyaline, transverse, ventricose, pearly in the inside; posterior side sometimes very short, rounded; anterior side more or less elongated, gaping; upper edge also gaping a little. Hinge with a small, rather elongated, triangular pit, and a marginal lamina in each valve, to the outer part of which is attached the somewhat short external ligament. Muscular impressions, two: these, equally with the muscular impression of the mantle, in which there is a large sinus, are indistinct.

Shells, in their endless diversity, present an inexhaustible fund for contemplation and delight. Select two shells of the same species, as much alike as possible, both in form and colour, and place them side by side. At first, perhaps, you see no difference. Look again, and you will observe that no two spots, nor bands, nor lines, nor tintings are exactly similar; and when you consider the number of shells that

belong to one genus, and the exquisite variety that diversifies the same pattern, you will be able to understand somewhat of the deep feeling which a lover of nature thus expresses:—My path leads towards the sea, and I stand musing on the firm beach; a few moments pass, and gently heaving billows deposit their tributes at my feet;—tributes from the ocean, to one, whose Elder Brother, the heir of all things, has restrained their further progress, and as such I welcome them. Ah! those tributes are exceeding beautiful —exquisitely-tinted sea-weeds, and shells of surpassing forms and hues. They speak to me; and their words, unlike those of the stars and thunder, breathe only of peace and love. They remind me of our Lord, who, when walking through the fields of Palestine, bade his disciples look upon the fragrant flowers, and listen to the song of birds, and trust in the loving-kindness of Him who careth for them.

Family XVII. Pholadaria.

We know not what thou art,
Nor what thy use, poor mollusk. Humble thou,
Loving to hide, in wood, or rock, or stone;
Yet wondrous is thy form—adapted well
To all thy parts, but most thy shelly home.

The family *Pholadaria,* though closely allied to the

Tubicola, differs, in the animals not forming a testaceous tube: and yet, although wanting, some analogy may be traced in certain accessory testaceous pieces, entirely foreign to the shell, and varying in size and number. Some species have also a coriaceous or horny tubular appendage at one end. The family includes two genera—*Xylophaga* and *Pholas*.

The *Xylophaga*, generally found in light pieces of wood or stick, which he penetrates to the depth of about an inch, is admirably formed for his subterraneous mode of life. The shell approximates closely in its general structure to that of the last genus of *Tubicola*. The valves are equal, inequilateral, and very much gaping: they resemble those of *Teredo*, but in place of the calcareous tube, they are merely furnished with two small accessory calyciform testaceous pieces, placed on the anterior side of the hinge. A small curved tooth is also discoverable in each valve, with an internal rib running from the umbo to the basal margin; two distinct muscular impressions are situated near the edge of the superior margin, the posterior large, the anterior smaller.

Pholades constitute one of the few genera established by Linnæus, that remain nearly entire; the construction

of their shells, together with the habits of the animal, being so peculiar and distinct as not to admit of further subdivision. The shell is equivalve, transversely oblong, very inequilateral, and gaping more or less at both ends; the dorsal margin, being very much reflected back, is generally divided by numerous transverse septa, and from within the umbo of each valve proceeds a strong spoon-shaped curvature or tooth. The external surface is uniformly of a delicate white colour, generally crossed longitudinally and transversely with fine muricated striæ. The interior is colourless, or rather of a pure or dusky white, though it sometimes partakes of a brownish cast; this deficiency is, however, amply compensated by the beautiful fretwork with which the shells of this genus are usually embellished. The accessory pieces are irregular in number, equally with their places of attachment, being formed within or on any part that requires protection, according to the necessities of the animal. They are, consequently, found more generally over the hinge. The animal resembles a fleshy membranaceous bag, nearly the length of the shell, and open at each end; furnished at the upper part with a cylindrical muscular tube, divided by a partition; at the lower, with a short, obtusely conical foot.

A number of loose stones are often left uncovered by the reflux of the tide, and few, in looking on them, would conjecture that some probably contain inhabitants of curious form and instincts. In each of them a *Pholas* often excavates his little cell; which he does by the help of a soft and pliant proboscis, having previously softened them, as the famous Carthaginian general, Hannibal, is fabled to have done, not indeed with vinegar, but by means of a peculiar secretion with which the creature is abundantly provided. His dwelling is generally oblique to the horizon, resembling a truncated cone, and terminated with a roundish cavity, which receives the body; whilst the furthest end is filled up with a proboscis, or pipe, of a fleshy substance and conical form, truncated at the end. This pipe the animal usually protrudes to the surface of the stone, for the evident purpose of drawing in the sea-water, on which he subsists, and of again rejecting it for a fresh supply.

Thus immerged, the *Pholas* subsists in indolence and plenty, and continues in seclusion, apparently without any desire to revisit the light of day. Yet the little prisoner is not so solitary as might at first appear, for many of the brotherhood congregate in the same rock; and their galleries, like those of miners, frequently open one into

the other. Whether these openings are casual or designed, we know not; but it is certain that considerable numbers of these little anchorites have sometimes been discovered within a few inches of each other.

The pillars which supported the proud temple of Serapis at Puteoli, are so completely perforated by these industrious creatures, as to present the appearance of honey-combs. Strange comment on the vanity of man! The sculptured columns of a temple, where busy feet were once heard, and to which active multitudes resorted, are now desolate and overthrown, a shelter to innumerable mollusks!

In some species the reticulations of the shell are so delicate as to resemble the finest lace; in others, they may be compared to small basket-work; and in the *P. costata*, or Ribbed *Pholas*, the shell is covered with regular, elevated, jagged, or scalloped ribs, gracefully disposed. But in all, we see the same subserviency to an especial use. The shell of the *Pholas*, if constructed in a similar manner to that of the Nautilus, Pearl-mussel, or garden Snail, would be little adapted to the habits of an animal which has frequently to excavate a tunnel through hard substances. An ovate or oblong form is consequently the best that could be adopted; and the points with which it is covered and adorned, are

evidently designed to protect the shell from external injury whilst its inhabitant is thus employed. At the same time a beautiful variety of tints evince that minute attention to the finishing and decorating of all created things which everywhere prevails. But why this feeble creature is instructed to form an excavation in sand or lime-stone, whilst others are permitted to range at liberty, we cannot understand; or how this object is effected by means of a peculiar secretion, has hitherto eluded our researches.

There is another quality in this tribe of mollusks, which demands a brief description. It is that of emitting a phosphorescent liquor, which illuminates whatever it touches. This peculiarity, observed by Pliny and other ancient naturalists, has furnished a subject for various observations and experiments to different learned men, especially to M. Réaumur and M. Beccarius, who particularly devoted their attention to the subject of phosphoric light.

The luminous quality of the *Pholas* is in proportion to its freshness; but even when in a dry state, it may be revived by the application of fresh or salt water. Brandy immediately extinguishes the light. A solution of sea-water increases it; sal ammoniac diminishes it a little; oil of tartar nearly extinguishes it, and the acids entirely.

The luminous water, when poured upon fresh calcined gypsum, rock crystal, or sugar, becomes more vivid. Milk rendered luminous by the *Pholas*, loses its shining quality when mixed with sulphuric acid; but regains it on the addition of oil of tartar. Coloured substances are differently and powerfully affected by it: white appears to imbibe and emit the greatest quantity; yellow and green in less proportions; red will emit hardly any light; violet least of all.

A single *Pholas* will render seven ounces of milk so beautifully luminous, that surrounding objects are clearly visible by its light. This luminous quality entirely disappears when the milk which contains it is excluded from the air; but again revives on exposure to the atmosphere. In the exhausted receiver of an air-pump, the *Pholas* loses his light.

The reason for this remarkable provision, as well as the purpose to which it is applied in the animal economy, are unknown. It is one of those extraordinary facts in natural history, which, like the playful meteors that often beautifully enliven the solitary woods with their agile and wandering lights, repeatedly invite the traveller to an unsatisfactory pursuit, and as frequently elude his vigilance.

The Greek word *pholeo*, from which the generic appellation of this extraordinary shell-fish is derived, signifies, "I

lie concealed in a cave;" therefore *Pholas*, "she who lies concealed in a cave," is a beautifully appropriate name, and designates a retiring disposition and local habitation.

Family XVIII. Tubicola.

Why so long,
E'en as strange creatures, have ye cross'd our paths,
Unheeded like driven leaves, which no one cared
To look upon?

The animal of the *Tubicola* is furnished with a small bivalve shell, either entirely free, or partially or wholly imbedded within the substance of a testaceous tube. This tube does not apparently form an immediate part of the organization of the animal, but merely an accessory, yet important, agent in protecting its inhabitant.

Mollusks of this curious family are found buried in wood, though mostly lithophagous; they perforate the holes and cavities by aid, no doubt, of a powerful solvent secretion from the glands. Five genera are referred to this family—*Aspergillum*, *Clavagella*, *Fistulana*, *Gastrochana*, and *Teredo*.

The shell of *Aspergillum* is extremely curious, and deserving of particular description. It is oval, equivalve, and

nearly equilateral, always remaining open, and supposed to cover a portion of the animal's back; in this position it becomes imbedded at the lower side of a long clavate testaceous tube, so that the umboes and complete form may be distinctly traced on the outer surface: the tube is then elegantly closed over by a convex disc, perforated with numerous tubular holes, like the rose of a common watering-pot. A small fissure is obvious in the centre, and the margin is surrounded by a conical frill or row of tubes, supposed to be filled with fleshy filaments from the mantle, in living specimens. The upper end of the tube, which is rarely perfect, is more or less attenuated, and, gracefully terminating in smooth undulations, is reflected at the margin; occasionally, however, the tube is straight, and slightly compressed. The reflected extremity is left entire at certain periods of growth, and the tube is recommenced according to the exigencies of the animal; some specimens have been discovered with four or five entire terminal reflections.

Observe the curious construction of the *Clavagella*, and the admirable appendage with which he is endowed. This creature is also found buried in stone, with the clavate or chambered end downward. The tube has a kind of per-

forated plate inserted at the bottom, analogous to the terminal disc of the one that pertains to *Aspergillum*; it is surrounded with minute spiniform tubes, probably filled also with certain fleshy filaments of the mantle. At the side of the chambered end is imbedded the fixed valve, somewhat pearly in appearance; and attached to the animal by two strong muscles, is the corresponding valve, hinging upon the other by a soft coriaceous ligament.

In the genus *Fistulana* a different construction is apparent. The bivalve shell is altogether free, and independent of the tube in which it is confined, while the lower end of the tube is inversely closed over. It consists merely of two irregular, inequilateral valves, gaping widely at the basal margin, and united by a soft ligament, and is enclosed in the lower expanded cavity of the long, straight, clavate tube, which it forms in the sand: the lower end is closed, the upper open.

The genus *Gastrochana* has been removed from the *Pholadaria* to the *Tubicola*, because, like the rest of their family, the animal lines the cavity, wherein he dwells, with a shelly substance, and also forms an unconnected tube for protection when not imbedded. The tube differs from that of *Fistulana*, in being often found in the open parts of

dead shells, in which case it forms a complete testaceous covering, entirely foreign to its place of attachment. The shell is inequivalve, inequilateral, gaping widely on the anterior side, and resembling an oblong oval; united by a ligament behind, and having in the interior a small spoon-shaped curvature, a character which becomes more fully developed in shells of the *Teredo* and *Phorus*.

Perforations in the timbers of many gallant vessels are caused by the *Teredo navalis*, or common Ship-worm, of which the generic appellation is derived from a Greek word signifying *to bore*. The formation of this curious mollusk bears an obvious reference as well to the purpose for which he is designed, as to the substance in which he becomes enclosed. The head is well prepared for encountering difficulties, being surmounted by a helmet, and provided with a tooth adapted for perforating the hardest substances; the neck is also furnished with strong muscles, which materially assist the operations of the head, and the body is covered with a kind of transparent horn. The heart is said to be situated in the back, and admits of only a single circulation, a peculiarity obvious in many animals that breathe in water. In like manner the extraordinary fact, that the breathing apparatus of the ship-worm, in

common with such mollusks as are unprovided with a cavity for the reception of salt water, are placed externally, evinces that their construction is in exact accordance with their mode of life. The animals turn readily in their respective shells, to which they merely adhere by a slight connection at one particular part: this arrangement is evidently designed to prevent the tubes from being disturbed by the motion of the inmates, which resembles that of boring.

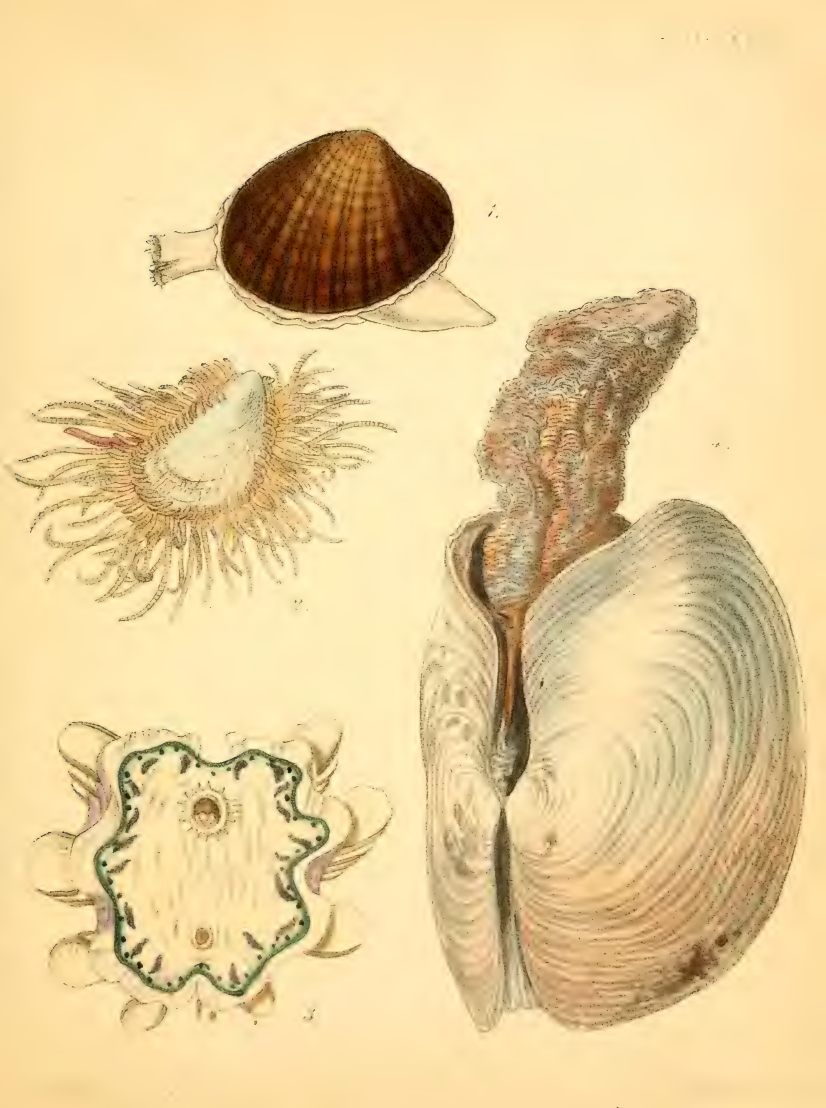
As the *T. gigantea*, or Great Bifurcated Borer, burrows in the mud, on which he cannot be supposed to subsist, a question has arisen whether the *T. navalis* receives any support from the wood which he destroys, or is solely supplied with food from the sea. The latter opinion is now generally adopted, as it appears, on close investigation, that the saw-dust received by the animal does not experience the slightest change.

When the hull of a vessel continues for any length of time in water, the *Teredines* appropriate it to their own use. They commence operations by making holes in the softest parts of the wood, and, as they have seldom at this period attained their full growth, the perforations are so small as to be scarcely discoverable. As soon as they have com-

pleted the habitations, their next care is to beautify, and render them commodious. This they effect by means of a white glutinous fluid, exuding, like the viscous juices of the common snail, which hardens into a sort of crust, and forms a thin smooth lining to their cells, protecting also their tender bodies from being injured by the roughness of the wood; and enabling them to move in various directions without inconvenience or danger.

They take the greatest care to avoid injuring a neighbour's dwelling. Each case, or shell, is preserved entire, and even where a piece of wood has been so completely perforated as to resemble a honey-comb, the slightest passage or communication has never been discovered between the different compartments, though the divisions have frequently not exceeded the thickness of fine writing-paper.

Is there nothing humiliating in the conclusion to which these facts lead? Would it not appear as if those floating castles, which open communications between different countries, are liable to be destroyed by the bite of an insignificant creature in order to teach mankind the weakness of their boasted strength? But mark the protecting care of Providence. The destructive operations of these insidious mollusks are in a great degree obviated by the sin-



gular fact of their generally boring in the direction of the grain.

Teredines abound in Holland, where the great rivers are held up by dykes at the height of twenty or even thirty feet above the level of the land. Here the *Teredines* frequently work their way into the wooden piles, which sustain these important barriers, and threaten their total demolition, if the precaution of sheathing their sides with copper, or a composition of tar and glass, has been neglected. During the year 1731, considerable apprehensions having been excited on this subject, persons were appointed by the Dutch Government to examine into their state. On drawing up one which had been driven in rather more than twenty years previously, it was found, though apparently sound on the outside, to be completely perforated within by innumerable *Teredines*, some of which exceeded a foot in length.

All the various parts of nature are beautifully designed to act in concert. In various instances, the lower we descend in the chain of creation, the more obvious are the uses, and the more extraordinary the instincts, of many of the links which compose it. Providence has mercifully provided that such should be the case; and the reason is clear: for, if the destructive and congregating propensities

of the whale and shark were similar to those of the *Teredo navalis,* the skill and ingenuity of man would be almost inadequate to counteract the machinations of such formidable and persevering foes.

Sea-worms have the same office assigned them in the water as *Termites* have on land. These insects, which to a casual observer appear solely occupied in spreading terror and destruction wherever they advance, are nevertheless of infinite importance to the well-being of mankind. They consume decaying vegetable substances of various kinds; they also resemble common flies in their general operations—those indefatigable little labourers, the pioneers of cleanliness and order, who continually employ themselves in perforating animal substances, and enabling the elements speedily to decompose and dissipate them. Their operations tend to elucidate those of the *Teredines,* with which it is impossible to become so accurately acquainted, from the nature of the element in which they subsist. We are, however, fully warranted in concluding, that, were it not for their incessant labours, the mighty rivers of the tropics would in time become impeded by the vegetable masses and innumerable trunks and branches of large forest-trees, which are continually carried into them; and that a consi-

derable proportion of these, from the preservative nature of salt water, would otherwise probably last for ages, form a basis for fresh accumulations, and eventually become productive of evils, of which it is impossible to form an adequate conception.

Nor is this all. The necessity which these feeble creatures impose upon the inhabitants of Holland of continually tarring and repairing their dykes and vessels, forms a bond of union between that country and Sweden, by occasioning a perpetual demand for oak, pitch, and fir. And as these apparently pernicious mollusks are at work at Amsterdam for the advantage of Stockholm, so the labours of insects in the north are equally profitable to the Hollanders, by promoting the consumption of salt, spices, and grocery, which are annually exported in large quantities, either for the purpose of seasoning and preserving the provisions of their northern neighbours, or to cure the fish which they use instead of bread.

Cease, then, to regard these creatures as obnoxious, the use of which you do not readily perceive. The *Teredo* is apparently an insignificant mollusk; nay, more, he appears on a slight acquaintance to be absolutely injurious: yet the Creator has assigned him an important

station among His works. The evil which he produces is readily obviated by a little care and contrivance; but the good which he is appointed to effect is doubtless considerable in the scale of nature.

> He who dwells
> Beside the lofty dykes which nobly breast
> A weight of waters, seeming to keep back
> The liquid force, which sternly threatens ruin,
> Doth hate his very name. And yet from him
> Men may derive the lesson, not to judge
> Things which they know not.

CHAPTER IX.

Class V. BRACHIOPODA.

"For wonderful, indeed, are all His works:
Pleasant to know, and worthiest to be all
Had in remembrance, always with delight."—*Milton.*

The last of the series of mollusks are also without head. Like the preceding class, they are provided with a shell consisting of two distinct pieces; but their peculiarity consists in being furnished with a pair of spiral arms, and in being differently placed within the shell. All live attached to foreign substances.

Their retractile arms are said to be in constant activity, and thus produce an inward current of water for the capture of small insects, and the drawing in of floating nutriment; and, as regards the position of the mollusk in his shelly home, the dorsal portion is against one valve, and the ventral against the other. The arrangement and position

of the *branchiæ*, or breathing-organs, differ materially from such as pertain to the Lamellibranchs: they consist of numerous beautiful veins and arteries, incorporated within the substance of the two lobes of the mantle. The calcifying organ of the *Brachiopoda* has, therefore, a double function: it not only secretes calcareous mucus for the formation of the shell, but is made subservient to the circulation of aerated fluid. Professor Owen has well observed, that, "in this profuse distribution of vessels over a plain membranaceous surface, we perceive the simplest construction of the *water-breathing* organ, presenting a beautiful analogy with the elementary forms of the *air-breathing* organ, as shown in the *Helices* and *Bulimi*, with their numerous relatives."

The muscular system in these singular mollusks is also most appropriate, though complex; the *Lingulæ* and *Orbiculæ* are provided with three pair of muscles, and the *Terebratulæ* with four. The large ones are destined to open and close the valves in the absence of a hinge filament, and the smaller assist in sliding one valve over the other for the admission of water.

With regard to the situation which the Brachiopodous mollusca should hold among their brethren, naturalists have

been much divided. The author of 'Conchologia Systematica' has, however, in accordance with his own opinion, and at the suggestion of Deshayes, adopted the higher rank assigned to them by Cuvier, and placed them next to the Lamellibranchs.

The animal thus wondrously constructed, and to whom the means of support are granted by the aid of a curious and complex apparatus, presents no external beauty. His form is ovate, or oblong; he is provided with spirally-twisted arms, as before mentioned,—also with several muscles; headless, he is without eyes, and has a central mouth.

The shell is either calcareous or horny, uniformly bivalve, having no hinge-ligament, but adhering firmly to the occupant by means of muscles: it is fixed externally to rocks or stones, or marine substances, either by a long pedicle or short fibrous tendon, or immediately by the lower valve.

Brachiopods include two small families, which are designated, from their mode of attachment, *Tendinosa* and *Ahhærentia*.

Family I. Tendinosa.

"The minutest throb,
That through their frame diffuses
The slightest, faintest motion,
Is fixed and indispensable."—*Shelley.*

Tendinous Brachiopods are divided from their sessile brethren in the same manner as the *Lepades*: the pedicle of the former, however, differs from the latter both with regard to its use and situation. Instead of supporting the shell, as in the instance above cited, or being used as a kind of nest for the reception of eggs, it serves to afford the animal a limited sphere of motion; thus causing him to sway gently, like many grasses that grow low upon the ground. Occasionally some of this curious tribe become attached by a number of short fibres passing through an orifice in the under valve. They are divided accordingly into two genera, *Lingula* and *Terebratula*; in the former of which the shell is equivalve, in the latter inequivalve.

In addition to peculiarities of construction or appendages, already mentioned, the shell of the *Lingula* may be described as being thin, either horny or calcareous, and of a green or somewhat ruddy colour, slightly beaked at the apex, and

generally open; and at the base rather acute, sometimes gaping. Two muscular impressions approximate near the centre in each valve. Mr. Cuming met with a considerable number of the *Lingula anatina* during his cruize amongst the Philippine Islands; he mentions that they are eaten occasionally by the natives, but he did not consider them as wholesome food. The fact of their having so long escaped the notice of travellers may be attributed to their peculiar mode of life—they live buried in hard sand, and may only be dug out at low water.

The genus *Terebratula*, from the extent of its geological relations, has always been one of considerable interest, and is, in fact, richer in fossil species than any other. The shell differs materially from that of *Lingula*, and consequently requires a brief description. It is inequivalve, inequilateral, oval, or orbicular, adhering by a rather short fibro-gelatinous tendon. The upper valve is produced at the apex, often curved inwards, and perforated for the tendon, with a single dentiform hinge-process on each side. Two slender, shelly processes, generally recurved and bent, pertain to the lower valve; the muscular impressions are indistinctly marked.

Such are the varied arrangements made for the comfort

and well-being of these humble mollusks,—these headless creatures, blind also, and incapable of motion. There is, also, much of beauty in the internal arrangement of their shells; for these, in common with others that pertain to the *Brachiopoda*, are distinguished by several interesting peculiarities of structure. When thin sections are examined by the aid of a high magnifier, the effect is exquisite: it seems as if the surface was raised with clusters of minute floral leaves, resembling those of the yellow everlasting, or globe amaranthus. This result undoubtedly proceeds from the effect of light and shade on the orifices of innumerable perforations.

A variety of appearances is presented also, according to the interesting statement of Dr. Carpenter, to which we have already referred, proceeding either from long flattened cells, or plications in the cell-membrane, and readily discoverable in even the minutest fragment. When also a portion of one of the shells has been completely decalcified by the action of dilute nitric acid, the membranous residuum presents a very remarkable structure, of which no trace is discoverable in ordinary bivalves. A series of tubular appendages are seen attached to the membranous films, corresponding in diameter to the shelly perforations, and

arranged at the same distances; of these the contents are distinctly cellular, resembling cells in the interior of glandular follicles. They lie in the perforations of the shell, and often on its inner surface, having distinct and independent terminations on the internal surface of the shell. The surface of the mantle, when carefully examined, is found to be studded with minute cells in that part which comes in contact with the shell, and each one exactly corresponds in size and aspect with those contained in the tubules. The purpose designed by such a curious structure is at present a mystery; it is, however, without doubt, of considerable importance in the economy of the mollusk.

This beautiful arrangement requires, for its development, to be magnified at least 150 diameters.

Family II. Adhærentia.

"Look on the frame
Of this wyde universe, and therein read
The endless kind of creatures which by name
Thou canst not count, much less their nature's aime,
All which are made with wondrous wise respect,
And all with admirable beauty deckt."—*Spenser.*

In this family the shell adheres immediately, though provided with a muscular tendon, that passes through a perfo-

ration or fissure in the lower valve. The valves are not united by any ligament, nor do they exhibit, except in the genus *Thecidium*, the cardinal processes or internal framework so characteristic of the *Terebratulæ*. Their shell is rather thin,—more horny than shelly. Three genera belong to this family—*Thecidium*, *Crania*, and *Orbicula*.

Thecidium.—This genus, intermediate between the two families of Brachiopods,—resembling the *Terebratulæ*, not only in shape, but in the cardinal processes,—differs in being imperforate, and without either pedicle or tendon. It is one of considerable interest to the geologist, and at the time of its first introduction by Defrance was known only in the fossil state. It is needless to speak further concerning the small, ovate, inequivalve, and nearly equilateral shell which pertains to the present genus, except to state that, as regards the interior of the shell, both valves are of a very pale greenish colour, and finely granulated, the lower valve being convex, the upper flat and curiously indented, as if to fit certain corresponding parts in the body of the animal. These indentations, which are spread round in a semicircular direction from the hinge, look as if they were pricked out in wax, and are occasionally filled with the dried remains of numerous fine cilia.

Of the genus *Crania*, few authors have acknowledged more than one recent species, but M. Hœninghaus, of Crefeld, asserts that two or three different species have been referred to the *Crania personata*. Neither cardinal processes, nor any indication of a hinge, pertain to the shell of this genus. The interior exhibits muscular impressions; the exterior appears compressed, somewhat square, inequivalve, with an upper convex and patelliform valve, and a lower one flat and attached.

The genus *Orbicula* is peculiar in the composition of its shells; they are rather horny than calcareous, and differ in their mode of attachment. Although fixed immediately to marine substances, one upon the other, they do not adhere by any portion of the shell, but rather by means of a cartilaginous tendon passing through a longitudinal fissure, situated in the centre of a small oval depression, pertaining to the lower valve, and which immediately afterwards expands and conceals the edges.

Love delighteth in small doings;—it is best shown in those little acts of kindness that form the joy of life. We have thought, when considering the wonderful construction

of many an obscure shell, or its molluscous inhabitant, that the Creator deigned by such means to make known his love and guardian care over all that lives and moves.

His majesty and power are manifested in the storm and whirlwind, in pealing thunders and scorching lightnings; but His "still small voice" of love is heard, speaking, as it were, ofttimes from the humblest of created beings.

THE END.

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